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Emmert R. Easton  
*South Dakota State University*

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## THE STATUS OF HORN FLY RESISTANCE IN SOUTH DAKOTA

Emmett R. Easton  
Department of Plant Science

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### Summary

Ear tags containing the organophosphate insecticide chlorpyrifos have been effective in the control of resistant horn flies in three western South Dakota localities during 1986. Resistance levels of 50-fold to pyrethroid insecticide were detected in horn fly populations at Cottonwood, Colome and Sturgis.

(Key Words: Resistance, Synthetic Pyrethroid, Horn Fly *Haematobia irritans*.)

### Introduction

Ear tags containing synthetic pyrethroid insecticide (Fenvalerate, Permethrin and more recently Flucythrinate) have provided excellent control of horn fly, *Haematobia irritans*, populations and have been of varying success in reducing face fly, *Musca autumnalis*, populations in South Dakota for over 4 years (Easton et al., 1985). In recent years, however, the situation has unfortunately been changing. A number of livestock producers near Martin and Mission in western South Dakota and others in the Cottonwood-Philip area of Jackson and Haakon Counties claim to have received poor horn fly control when using ear tags in late 1985. Many producers in Bennett, Jackson, Stanley, Todd and Tripp Counties did not purchase ear tags in 1986 due to their experiences with the lack of control in 1985 so many farm stores in western South Dakota are not currently selling these products and are promoting alternate means of control.

Resistance to the pyrethroid materials in ear tags was first reported in Florida in 1983 and by 1985 resistant fly populations were affecting cattle in 10 states in the Great Plains (Kunz and Schmidt, 1985). When similar resistance behavior was detected in the Valentine area of north central Nebraska, three farms in the Mission area of South Dakota in late 1985 were also observed to have numbers of horn flies that averaged 200 per animal. Animals tagged with Ectrin (fenvalerate insecticide) ear tags under contract with the Ralston Purina Company were observed to have horn fly populations of over 250 flies per side on an animal when observed in August of last year (Jack Shugart, personal communication, Ralston Purina Company).

A need existed to determine whether resistance was a major factor operating in South Dakota which would account for poor horn fly control currently reported in much of our state west of the Missouri River. If resistance was the problem, alternate means of control would need to be developed.

## Experimental Procedure

In order to determine if resistance existed, a filter paper assay technique was employed to monitor the resistance to pyrethroids.

With the aid of a heated sharp instrument, a 1/4" round hole was melted into the bottom of 21 3 3/4 x 7/8" plastic petri dishes just large enough to accommodate the end of a glass tube from a battery powered aspirator. Six to eight smaller holes 1/6" in diameter were also melted through the bottom of each dish to provide air for the flies but not large enough to permit them to escape.

Filter papers were treated with a 1-ml series of dilutions of a synthetic pyrethroid insecticide (Fenvalerate) at the dosages of 12.5, 6.25, 3.125, 1.562, .781, .391, .195 and .0977, respectively (method of D. C. Sheppard, unpublished). After treatment filter papers were kept in aluminum foil packets to prevent decomposition. When ready to use, the papers were placed in the top of each petri dish and the bottom of the dish placed on as if it were on the top. The assembly was then taped together.

Horn flies were netted off of the cattle at (1) the Cottonwood Range and Livestock Research Station, (2) the SDSU cow-calf herd at Fort Meade and (3) the ranches of Ohmer Cook and Clifford Fees near Cottonwood and Chandlor Shippy south of Colome. A barley cow-cake food supplement containing molasses was used to attract the animals at the Cook and Fees' ranches. Flies were taken off the backs of animals when herded into a chute at the Cottonwood Station, at Fort Meade and near Colome.

After flies were netted from the cattle, they were aspirated from the net and 12 to 15 allowed to enter each petri dish. The 1/4" opening was then sealed with tape to prevent fly escape. All petri dishes with flies were placed in a cool box to prevent death from high temperatures. After 2 hours, all flies that were obviously dead and any unable to stand were counted as dead. Numbers of dead flies were also counted after 8 and 24 hours. The percentage kill at each level was computed including a check. The check consisted of a petri dish with an untreated filter paper. The percentage kill was plotted against the dosage level on semi-log probit graph paper. A "best fit" line was drawn to determine the LC<sub>50</sub> of the population. An LC<sub>50</sub> for each herd was divided by a susceptible LC<sub>50</sub> of .13 g/cm to determine the resistance factor (R/S). The LC<sub>50</sub> is defined as the dosage that kills 50% of the population.

Insecticide ear tags containing 5.0% chlorpyrifos and 7.0% cypermethrin synergized with 3.5% piperonyl butoxide (Max-Con, Y-Tex Corporation) were evaluated as an alternate management strategy on beef cattle herds in three areas of the state where resistant horn flies were suspected to be present. Ear tags were supplied at the rate of two per animal to Black Angus cattle at the Cottonwood Range and Livestock Research Station in Jackson County and to herds owned by Chandlor Shippy and the Ireland Brothers near Colome, Tripp County, and Martin, Bennett County, respectively.

## Results and Discussion

An economic threshold of 50 flies per side has been recommended for horn flies affecting beef cattle on the Northern Great Plains. When horn fly numbers exceed this threshold, economic losses in terms of reduction in the rate of gain affect the livestock producer. Two beef cattle herds monitored for horn fly populations in western South Dakota during the 1986 summer season (table 1) had fly numbers that exceeded the economic threshold from July 7 through the month of August, even though the animals had been treated earlier with synthetic pyrethroid ear tags. Numbers of flies on herds treated with the pyrethroid ear tags were at least as high as the numbers of flies on herds where no insecticidal control was maintained.

Where ear tags, on the other hand, containing an organophosphate insecticide (chlorpyrifos or Dursban) were used on neighboring herds of cattle in two of these areas, a considerable reduction of horn flies was noted (table 2). This information suggested that resistant horn fly populations were widespread in the region and when fly populations reached approximately 200 flies per side by August, efforts were made to test live material for resistance to pyrethroids (table 3).  $LC_{50}$  values of above .13 g/ml indicate a probable resistant population and provide evidence why poor fly control is being achieved in these areas with the use of synthetic pyrethroid ear tags containing fenvalerate or permethrin. Even though herds in other areas have not been tested at this time, there is good likelihood that resistance to pyrethroid insecticidal ear tags is now widespread throughout western South Dakota. Herds of cattle in the Ft. Pierre area that were tagged with pyrethroid materials were noted to have horn fly numbers greater than 50 flies per side during July, 1986.

Producers in 1987 should refrain from using ear tags containing pyrethroid materials on their animals and use a tag containing an organophosphate material. A special 24C state label for the Max-Con tag containing chlorpyrifos has been applied for by the Y-Tex Corporation and this product will hopefully be available in farm stores in 1987. Tags containing tetrachlorvinphos or Rabon (originally developed by the Diamond Shamrock Company) are an alternate product still available from the SDS Biotech Company (now Fermenta Animal Health). There is increasing evidence, however, in the states of Nebraska and Kansas that the Rabon tag does not last longer than 3 months. Producers wishing season-long fly control will have to retag later in the summer when using this product. A 20% Diazinon tag may also be available to producers in 1987 if a state label is approved.

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TABLE 1. THE FAILURE OF SYNTHETIC PYRETHROID  
IMPREGNATED EAR TAGS TO CONTROL HORN FLIES ON  
TWO RANCHES IN WESTERN SOUTH DAKOTA IN 1986

Date	Mean number of horn flies/side	
	Martin <sup>a</sup>	Cottonwood <sup>b</sup>
July 7	161	--
July 24	85	123
July 31	151	140
August 7	--	109
August 14	72	--
August 28	157	265

<sup>a</sup> Herd owned by the Ireland Brothers was treated with Permethrin Y-*Tex* Gard star ear tags at the rate of one tag per calf, two tags per bull and none in the cows.

<sup>b</sup> One-half of a herd of cattle owned by Ohmer Cook was tagged with Ectrin ear tags (containing fenvalerate) at the rate of one tag per animal and the remaining half with Y-*Tex* Gard star tags containing Permethrin.

TABLE 2. EFFICACY OF MAX-CON® INSECTICIDE IMPREGNATED EAR TAGS CONTAINING 5.0% CHLORPYRIFOS AND 7.0% CYPERMETHRIN WITH SYNERGIST FOR THE CONTROL OF RESISTANT HORN FLIES ON THREE WESTERN SOUTH DAKOTA RANCHES DURING 1986

Date	Week	Locality			Control
		Colomea <sup>a</sup> Tripp Co.	Martin <sup>b</sup> Bennett Co.	Cottonwood <sup>c</sup> Jackson Co.	
May 28	Pretreatment	67.3 <sup>d</sup>	77.3	70.0	65.0
June 15	Posttreatment	3.0	4.0	6.0	70.0
July 7	5	2.0	6.1	5.0	30.0
July 24	7	8.1	5.1	3.4	94.0
July 31	8	2.9	1.0	5.3	140.0
Aug 7	9	5.4	--	6.2	88.8
Aug 14	10	6.7	7.1	9.0	47.6
Aug 21	11	17.2	16.3	15.0	108.0
Aug 28	12	12.1	22.4	25.3	102.0
Sept 4	13	31.5	--	22.3	151.0
Sept 12	14	--	14.3	14.1	77.3
Avg mean		9.8	9.5	11.2	90.8
		% Control			
June 15		95.7	94.3	91.4	
July 7		93.3	79.5	83.3	
July 24		91.3	94.6	96.4	
July 31		97.9	99.3	96.2	
Aug 7		93.8	--	93.0	
Aug 14		85.9	85.2	81.1	
Aug 21		84.0	84.9	86.1	
Aug 28		88.1	78.0	71.0	
Sept 4		79.1	--	85.2	
Sept 8		--	81.5	81.8	
Avg mean		89.9	87.2	86.5	

<sup>a</sup> Herd owned by Chandlor Shippy.

<sup>b</sup> Herd on ranch owned by the Ireland Brothers.

<sup>c</sup> Cottonwood Range and Livestock Research Station.

<sup>d</sup> Mean number of horn flies per 15 animals. Animals tagged on June 1 at rate of two tags per head.

TABLE 3. HERDS OF BEEF CATTLE TESTED IN WESTERN SOUTH DAKOTA  
FOR RESISTANCE TO PYRETHROID INSECTICIDES USING THE FILTER  
PAPER RESIDUE TECHNIQUE OF SHEPPARD

Date	Ranch	County	LC <sub>50</sub>	R/S <sup>a</sup>
August 1, 1986	Ohmer Cook	Jackson	6.9 <sup>a</sup>	53
August 8, 1986	Clifford Fees	Jackson	6.8 <sup>a</sup>	52
August 14, 1986	Cottonwood Range and Livestock Research Station	Jackson	6.8 <sup>a</sup>	52
August 28, 1986	Chandler Shippy	Todd	6.8 <sup>a</sup>	52
August 28, 1986	Ohmer Cook	Jackson	6.9 <sup>a</sup>	53
Sept. 26, 1986	Ft. Meade, SDSU	Meade	6.4 <sup>a</sup>	49

<sup>a</sup>  
R/S =  $\frac{LC_{50}}{.13 \mu\text{g}/\text{cm}^2}$

<sup>b</sup>  
g/cm<sup>2</sup>.