TECHNICAL BULLETIN

HORN FLIES

Understanding, Managing and Controlling Resistance Development

Horn flies are more than just an annoyance. Primarily residing on the backs of cattle, horn flies bite into the skin and suck blood as often as 40 times a day resulting in blood loss, intense irritation, reduced averaged daily gain, feed efficiency and milk production. The cost to the industry is approximately $700 million each year.[1]

Compared with non-treated cattle, those treated for horn flies consistently produce calves that weigh 20 to 27 pounds more at weaning.[2] Proper horn fly control measures can increase net return by $8 for each $1 invested.[3]

However, producers need to be aware of the potential of resistant populations of horn flies developing and manage accordingly.

What is resistance? How does it occur?

Resistance is the genetic ability of an insect to live through a labeled application of a parasiticidal product. When insecticide exposures are infrequent, the level of resistance that an insect population expresses will remain at relatively low levels. However, when selection pressure from more frequent exposure to insecticides occurs, the result is a fly population that exhibits increased levels of resistance. As the insecticide is applied more frequently or at higher concentrations in an effort to control the pests, the surviving population becomes even more resistant and difficult to control.

Multiple resistance, which is the ability of an insect population to develop resistance to more than one class of insecticide, is something many cattle producers and entomologists fear. Of concern is that if this type of resistance does develop in the horn fly, there will no longer be economical methods of control.

While valid, there is strong evidence suggesting horn flies have a limited capacity to develop high levels of multiple resistance. Researchers at New Mexico State University (McKenzie and Byford 1993) evaluated horn fly resistance to synthetic pyrethroids and organo-phosphates applied in different manners.[4] Their findings indicate that as horn flies obtained high levels of resistance to pyrethroids, they simultaneously demonstrated a higher level of susceptibility to the organo-phosphate.

"…rotating the class of active ingredient used in insecticide ear tags on a yearly basis is not frequent enough to prevent or control the development of resistance."

[1]Journal of Animal Science 1992. 70:597-602. [2]Campbell, John B., 2006. Horn Fly Control on Cattle. University of Nebraska-Lincoln Extension, Neb Guide - G1180.[3]Hoelscher, Compendium, April 2000.
[4]McKenzie CL, Byford RL. 1993 Journal of Economic Entomology Vol 86, no.4 1040-1080 The New Mexico State Study. Jiang Yc. 1993 Resistance Pest Management

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How to manage resistance

There can be as many as 16 horn fly generations during a season so rotating the class of active ingredient used in insecticide ear tags on a yearly basis is not frequent enough to prevent or control the development of resistance.

Table 1. Synthetic pyrethroid resistance development in horn flies exposed to either continuous pyrethroid treatment, pyrethroid alternated with an organo-phosphate or a mixture

Type of insecticide treatment	Continuous	Alternating	Mixture
Horn fly generation at which resistance developed	21	22	40
Maximum tolerance developed (a)	1470	269	8.54
Generation in which maximum tolerance developed	44	47	50
Average tolerance before onset of resistance	1.62	1.53	1.5
Average tolerance after onset of resistance	344.8	116.4	4.48

(a) Tolerance measured as concentration of insecticide required to reach LC50. Numbers indicate fold increase in concentration required to reach the LC50 for treatment groups as compared to susceptible control group.

As Table 1 of the New Mexico study shows, when a four-month rotation was used with a synthetic pyrethroid and an organo-phosphate, the onset of pyrethroid resistance occurred at the same time for both the continuous and rotational application of different insecticidal classes. However, when both synthetic pyrethroid and organo-phosphate were mixed together, the onset of resistance was much later (19 and 18 fly generations more than for continuous and alternating treatments, respectively) and pyrethroid resistance level was substantially less (1461 and 260 fold less than continuous and alternating, respectively.)

Table 2. Organo-phosphate resistance development in horn flies exposed to either continuous organo-phosphate treatment, organo-phosphate alternated with pyrethroid or a mixture

Type of insecticide treatment	Continuous	Alternating	Mixture
Horn fly generation at which resistance developed	31	37	37
Maximum tolerance developed (a)	7.24	3.78	4.81
Generation in which maximum tolerance developed	35	39	50
Average tolerance before onset of resistance	1.39	0.96	1.27
Average tolerance after onset of resistance	5.88	2.31	2.94

(a) Tolerance measured as concentration of insecticide required to reach LC50. Numbers indicate fold increase in concentration required to reach the LC50 for treatment groups as compared to susceptible control group.

The New Mexico workers also evaluated resistance when an organo-phosphate was applied to horn flies in a continuous manner, rotated or mixed with a synthetic pyrethroid. They found that the overall level of resistance development was much less than was exhibited for the pyrethroids (Table 2).

The rotational and mixed application treatments were equal in terms of delaying the onset and magnitude of resistance when compared to a continuous treatment. The implications of this work are extremely important in the way horn fly control programs are developed and implemented.

The simultaneous application of two different classes of insecticides may very well be more effective in delaying the onset and minimizing the magnitude of resistance development than the rotational application of two different insecticide classes. Mixed applications of insecticidal classes are also being used in other insect management programs where resistance development has been a problem. Scientists have discovered that the onset of resistance can be delayed and its overall magnitude diminished by utilizing insecticide mixtures to control the cotton bollworm.

Solution: Insecticide ear tags with two active ingredients.

Insecticide ear tags have been a valuable tool to the cattle producer for controlling flies. However, as the majority of the commercial products available only contain only one active ingredient, resistance to the actives by horn flies has developed. Accompanying this resistance has been less-than-satisfactory results of many commercial insecticide ear tag products.

The best approach to manage resistance is by using a combination insecticide ear tag with two active ingredients.

Double Barrel™ VP insecticide ear tags contain two active ingredients – an organophosphate (14% pirimiphos methyl) and a synthetic pyrethroid (6.8% lambdacyhalothrin) – that are more effective than single chemistry ear tags. And because there are two active ingredients, resistance development is minimized without having to rotate ear tags with different of insecticide.

Double Barrel VP insecticide ear tags provide quick knock down and control of horn and face flies for up to five months on beef and non-lactating dairy cattle and calves of all ages.

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