

# Technical White Paper



## The Effect of ClariFly® Larvicide in Feed on Fly Populations on Dairy Farms in Northern Vermont in 2008

Heavy populations of house and stable flies can negatively effect the health and performance of dairy cattle (Christenson, 1982, Byford et al., 1992), not to mention the nuisance and annoyance they cause for farmers and their surrounding neighbors. Reducing fly populations on dairy farms can increase cow comfort and reduce the spread of disease pathogens. Dairy operations typically implement an IPM (Integrated Pest Management) Program to deal with flies that include conventional insecticidal sprays, baits, traps and parasitic wasps. However, these practices need to be repeated frequently to achieve adequate control, adding to increased labor and costs.

ClariFly® Larvicide is a feed additive that disrupts the development of fly larvae and reduces the emergence of adult flies from the manure of treated animals. The active ingredient in ClariFly® Larvicide, diflubenzuron, is a chitin synthesis inhibitor. Without chitin, flies are unable to properly form their exoskeleton during molting and die before they can become adult flies. This mode of action is different than conventional insecticides that attack the nervous system of adult insects.

During the summer of 2008, a study was conducted by the William H. Miner Agricultural Research Institute (Chazy, NY) at several dairy farms located in Northern Vermont (Mooney, et al 2009). The objective of the study was to determine the effectiveness of ClariFly® Larvicide on fly populations on dairy farms when included in feeds as compared to use of conventional fly control methods. The study was established using a randomized block design, utilizing 12 dairy farms. The 12 dairy farms were assigned to six blocks by herd size, geographic location and lactating herd housing. Parameters such as landscaping around barns, barn floor plan, manure management systems, and feed bunk placement were also considered in an effort to reduce within-block variation. The study was initiated on June 15, 2008 and conducted over 108 days with fly populations sampled by block once every 14 days. Since one dairy did not keep calves and two others only had temporary housing, after the completion of the study the dairies were reblocked according to calf housing for analysis of fly populations.

Block Assignment	Cow Herd Size, n	Lactating Cow Housing	Calf Housing	Post Experiment Calf Housing Block
Control A	215	Freestall	Barn	Control Z
Treated A	225	Freestall	Barn	Treated Y
Control B	270	Freestall	Hutches	Control W
Treated B	440	Freestall	–	–
Control C	150	Freestall	Temporary	–
Treated C	126	Freestall	Hutches	–
Control D	75	Tiestall	Temporary	–
Treated D	130	Tiestall	Barn	Treated Z
Control E	204	Freestall	Barn	Control Y
Treated E	155	Freestall	Barn	Treated X
Control F	450	Freestall	Barn	Control X
Treated F	440	Freestall	Hutches	Treated W

On treated dairy farms, ClariFly® Larvicide was added to all purchased feeds. These feeds were prepared and purchased from local feed mills and were provided for the duration of the study. The inclusion rate in the feed was at the labeled rate of 0.10 mg diflubenzuron/kg BW/day. Dairy farms in the treated group were asked to discontinue all other fly management practices and comply with all ClariFly® Larvicide recommendations. Dairy farms in the control group were allowed to continue their regular fly management practices with the exception of the use of any feed additive fly control products. Fly control methods on all dairy farms were recorded as to products used, application dates, application rates, and any other pertinent information.

## FLY POPULATION MONITORING

Fly populations were monitored by using fly speck cards. Fly speck cards are used as tool to monitor fly populations by evaluating the number of fecal and vomit spots on the face of each card. (Axtell, 1970; Lysyk and Axtell, 1985). For each data point, a standard 3 X 5 index card was labeled on the back with the dairy name, date, and placement location and secured to each pre-designated station and left for two weeks. After two weeks of exposure, the fly speck card was removed and replaced with a new fly speck card. The removed cards were then counted for the number of fecal and vomit spots. Fly specks cards were counted independently by two technicians and the analyzed counts were an average of the two counts.

At each dairy, one lactating cow barn and the calf location were examined for ideal fly speck card placement. Speck card placement was determined by observing locations that maintained a uniform fly population. In each of the lactating cow barns, three locations were established at  $\frac{1}{4}$ ,  $\frac{1}{2}$ , and  $\frac{3}{4}$  along the length of lactating cow housing. Fly speck cards were placed in similar locations within blocks. Stations were sheltered from rain, prevailing winds, and direct mechanical ventilation and were placed approximately 8 ft from floor. Fly speck cards were held in place with 1 in. binder clips.

Fly speck card placements located in the calf housing were approximately 3.9 ft above the floor. In dairies that used hutches, the fly speck cards were attached to the ceiling of the hutch. In both placements, calves were restricted from contacting the fly speck cards. Fly speck cards in the calf housing were placed inside a folded wire mesh (6.9 in. by 7.9 in. mesh with 1 in. x 2 in. on-center openings folded to 6.9 in. by 3.9 in.) to hold them in place.

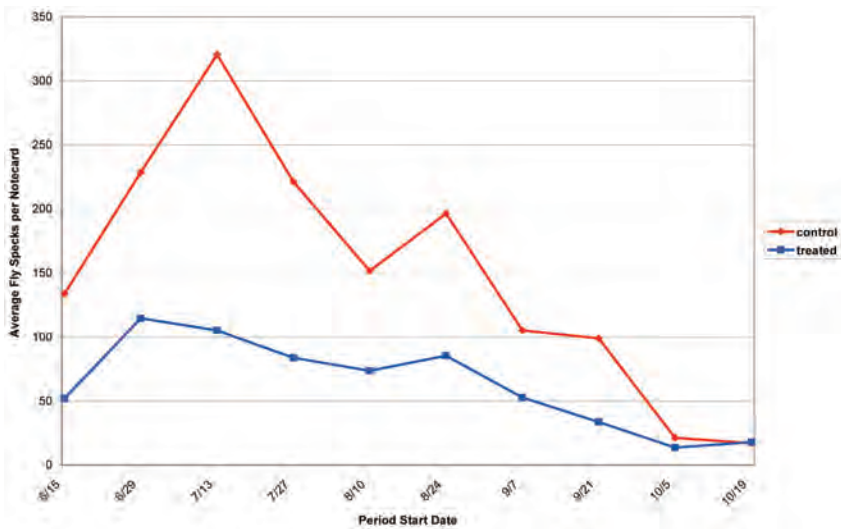
## ADDITIONAL DATA COLLECTION

At each visit, wind speed (km/h), temperature (°C), and cloud cover (nearest quartile) were recorded. At each biweekly visit, bulk tank milk fat percentage, bulk tank milk protein percentage, bulk tank somatic cell count, and bulk tank milk shipped per cow were recorded. Data was also collected prior to the initiation of the study for comparison against measurements during experiment. Samples of all purchased feeds on the treated dairies (approximately 1.1 lbs.) were taken at each visit, to confirm by chemical analysis, that the appropriate amount of ClariFly® Larvicide was included.

## RESULTS & CONCLUSIONS

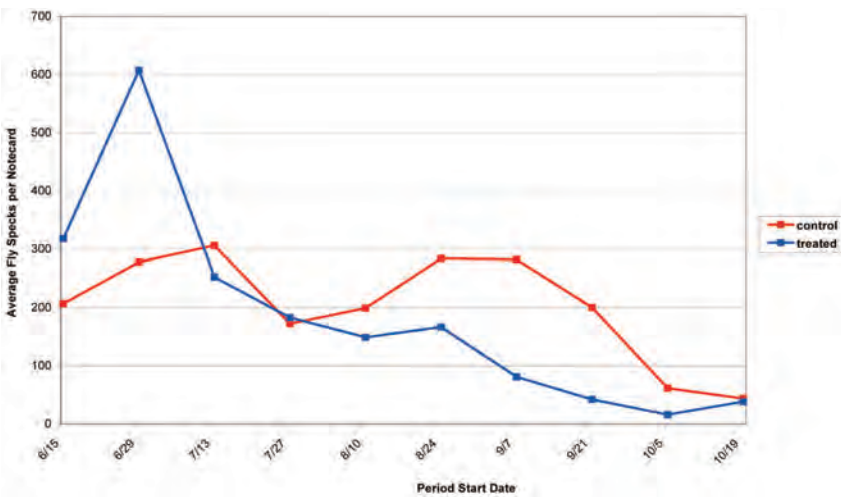
Data were analyzed as a randomized block design with main effects of random block, treatment, period, and treatment by period interaction in MIXED procedure of SAS. Period effects ( $P < 0.01$ ) reflected normal seasonal changes in fly population.

In treated dairies, fly speck counts decreased in the lactating herd housing when compared to control dairies (58 vs. 132 per card,  $P < 0.02$ ) indicating that the larvicidal treatment was impacting the fly population. Inclusion of ClariFly® Larvicide in purchased feeds significantly reduced fly populations in lactating dairy cow housing versus untreated controls. ClariFly® Larvicide reduced fly populations over control dairies even when conventional fly management practices were in place at the non-inclusion dairies. ClariFly® Larvicide is often used as part of an IPM program that would implement concomitant practices, including baits and traps to kill migrating adult flies that fly from neighboring farms or breed in other organic matter besides treated manure. Under this type of program, even greater differences would be expected.



Average fly specks per speck card in lactating cow housing by experimental period for control and treated dairy farms. (Treatment effect was  $P = 0.014$ . Period effect was  $P < 0.0001$ . Treatment by period interaction was  $P = 0.072$ .)

In the calf areas, original blocking of the groups made it difficult to compare fly population numbers between treated and control groups as the study design did not take into account calf housing or calf numbers. Upon analysis of the data, dairies were reblocked according to calf housing for analysis of fly populations in calf housing areas. After reblocking, analysis of the fly population did not indicate a significant difference between control groups and treated groups. The data did show a large drop in fly population in the treated dairies after the first two weeks of the study. The lack of more significant differences in efficacy in calf housing between groups is likely related to inefficiency in feeding and/or limited intake of the treated calf starter during the first weeks of life. All treated starters were formulated at 2.2 pounds of ClariFly® Larvicide per ton of feed and assumed that a 150 pound calf would eat a minimum of 2 pounds per head per day with consumption increasing proportionally with bodyweight. However the data indicates that adequate consumption was not achieved, resulting in high levels of fly populations early in the trial. To compensate for feeding inefficiencies, it is recommended that calf starters be formulated based on the heaviest expected calf weight eating the least expected amount of feed (e.g. 0.5 lb starter on 150 lb calf). This will better ensure sufficient diflubenzuron is deposited in the calf manure. It is also anticipated that if ClariFly® Larvicide were incorporated into milk or milk replacers a difference in fly populations could have been seen.



Average fly specks per speck card in calf housing by experimental period for control and treated dairy farms. (Treatment effect was  $P = 0.444$ . Period effect was  $P < 0.0001$ . Treatment by period interaction was  $P = 0.073$ .)

There was a trend for improvement in milk yield, composition, and somatic cell count during the treatment period, but more defined experimentation is needed before firm conclusions can be drawn about cause and effect. However, there was no negative impact on milk yield and composition through the inclusion of ClariFly® Larvicide in the feed.

Bulk tank measurements of milk yield and composition for control and treated dairy farms using all experimental periods and preexperiment covariates.

All Periods	P values						
	Control <sup>1</sup>	Treated <sup>1</sup>	SE	COV <sup>2</sup>	TMT <sup>2</sup>	PER <sup>2</sup>	T × P <sup>2</sup>
Milk shipped, lbs/cow	68.2	71.5	1.45	<0.0001	0.001	0.006	0.122
Milk fat, %	3.69	3.80	0.073	0.399	0.316	0.106	0.691
Milk protein, %	3.02	3.05	0.022	0.034	0.421	<0.0001	0.428
SCC, ×1000/ml	223	196	13.6	0.165	0.190	0.133	0.684
SCS	4.1	3.9	0.09	0.046	0.268	0.177	0.730

<sup>1</sup>Least square means back-transformed.

<sup>2</sup>COV is effect of pre-experiment covariate, TMT is effect of treatment, PER is effect of period, and T × P is effect of treatment by period interaction.

## REFERENCES

Axtell, R.C. 1970. Integrated fly-control program for caged-poultry houses. *J.Econ. Entomol.* 63:400-405.

Byford, R.L., M.E. Craig, and B.L. Crosby. 1992 A review of extoparaistes and their effect on cattle production. *J. Anim. Sco.* 70:597-602.

Christensen, C.M. 1982. External paraiste of dairy cattle. *J. Dairy Sco.* 65:2189-2193.

Lysyk, T.J. and R.C. Axtell. 1985. Comparison of baited jug-trap and spot cards for sampling house fly, *Musca domestica* (*Diptera: Muscidae*), populations in poultry houses. *Environ. Entomol.* 14:815-819.

Mooney, C.S., E.E. Osmanski, R.E. Butzler and C.S. Ballard. 2009. The effect of ClariFly® Larvicide in purchased feed populations on dairy farms in northern Vermont in 2008. Final Research report William H. Miner Agricultural Research Institute.