ClariFly®
LARVICIDE

FLY FREE & ON FEED.

TECHNICAL INFORMATION

Fly control for the Dairy Farm and Feedlot

PRODUCTIVE, FLY FREE CATTLE START WITH CLARIFLY® LARVICIDE

ClariFly® Larvicide is a feed supplement that prevents **house flies, stable flies, face flies, and horn flies** from developing in and emerging from the manure of treated cattle. Unlike conventional insecticides that attack the nervous system of insects, ClariFly® Larvicide works by interrupting the fly's life cycle, rather than through direct toxicity. When mixed into cattle feed, ClariFly® Larvicide passes through the digestive system and into the manure. With only very small concentrations, it is able to disrupt the normal molting process of the fly larvae. The mode of action is specific to insects. It disrupts the production of a substance called chitin, which is a key component of an insect's exoskeleton that is NOT found in mammals. Without a properly formed exoskeleton, the immature fly cannot survive to adulthood.

NOT A CONVENTIONAL PESTICIDE

The active ingredient in ClariFly® Larvicide, diflubenzuron, is considered by the Environmental Protection Agency (EPA) to pose a low risk to human health and the environment. Diflubenzuron has the following advantages over existing conventional pesticides:

- Low impact on human health
- Lower toxicity to non-target organisms (birds, fish, plants)
- Low potential for groundwater contamination
- Low use rates
- Compatibility with Integrated Pest Management (IPM) practices

ClariFly® Larvicide is able to exert its effect with little risk to human health and the environment and is therefore an ideal fly control choice for today's environmentally conscious producer.

ClariFly® LARVICIDE

FLY FREE & ON FEED.

FLY IDENTIFICATION & INFORMATION

HOUSE FLY *(Musca domestica)*

- Non-metallic dull grayish color with 4 distinct stripes on the thorax and a pale yellowish abdomen
- Feeds on human food, animal waste and garbage with sponging mouth parts
- Can deposit 150 eggs at a time breeding in fresh manure, compost, spilled feed or wet organic matter
- The most abundant fly species around livestock operations
- Breeds prolifically, so populations can increase dramatically in a short period of time

STABLE FLY *(Stomxys calcitrans)*

- Similar to the house fly in coloring, but slightly smaller with a checker-board pattern on the abdomen
- Feeds on blood with piercing mouth parts penetrating the skin of both animal and human hosts
- Deposits eggs in masses - up to 50 at a time - breeding in fecal material mixed with debris as well as in wet grass clippings and compost
- Breeds and feeds primarily during the day
- Known to cause reduced weight gain in beef cattle and reduced milk production in dairy cows

FACE FLY *(Musca autumnalis)*

- Similar to the house fly in coloring, but slightly larger with a fuller gray color and a yellowish/orange abdomen
- Feeds on secretions around the eyes, nose and mouth of cattle with sponging mouth parts
- Lays eggs only in fresh, undisturbed cattle manure
- Can be found in large numbers in attics of buildings
- Newly emerged adults may diapause, which delays reproduction until the following spring

HORN FLY *(Haematobia irritans)*

- Small biting flies about half the size of house flies with gray coloring and 2 stripes on the thorax
- Feeds on blood of animals with piercing mouthparts, taking up to 40 blood meals a day
- Female horn flies only leave their hosts to lay their eggs in freshly deposited cow manure
- Typically found congregating on the backs of cattle
- Known to cause reduced weight gain in beef cattle and reduced milk production in dairy cows

ECONOMIC IMPACT

As unchecked fly populations grow, their impact on an operation's profitability can be measured within an economic threshold. The economic threshold is defined as the level of flies in which the economic loss is equal to the cost of controlling.

HOUSE FLY

The house fly has been implicated in the transmission of 65 disease organisms, such as the bacteria that causes Mastitis, some of which can be spread to cattle inflicting economic damage. Another house fly associated economic threat to cattle facilities is nuisance lawsuits. If left untreated, the house fly's prolific reproduction rate can spread populations to nearby properties creating complaints and generating potential fines from neighboring communities.

KNOWN TO TRANSMIT 65 DISEASE ORGANISMS

Large populations of house flies can spread disease that may affect cattle production and development.

STABLE FLY

The economic injury level for feeder cattle is when the stable fly population reaches an average of about five flies per front leg.[1]

The economic threshold of just five flies per animal showed a reduction in feed efficiency that resulted in an average loss of $8.51 per animal per season.[2]

$8.51

AVERAGE LOSS PER ANIMAL PER SEASON FROM JUST 5 FLIES PER COW

Parasitic stable flies feeding on cattle legs inflict a painful bite that can influence milk production.

1 McNeal & Campbell (©1981)
2 John B. Campbell, The Economic Significance of the Stable Fly, Dec. 1992

FACE FLY

The face fly is an excellent vector for eye diseases since it repeatedly feeds on eye fluids and frequently moves from one animal to another. Face flies have been implicated in the transmission of ***Moraxella bovis***, a bacterium that is the primary causative agent of infectious bovine keratoconjunctivitis (pinkeye). Costs associated with pinkeye from decreased weight gain, reduced milk production, and treatment are estimated to be $150 million in the U.S. alone.[3]

$150,000,000

ECONOMIC LOSS PER YEAR DUE TO FACE FLY INFESTATIONS

Face flies swarm the neck and face, feeding on fluids and causing cattle irritation.

HORN FLY

The economic losses from horn flies cost the North American cattle industry over $1 billion per year.[4] These losses can be attributed to reduced weight gains, decreased feed efficiency and decreased milk yields caused by loss of blood and excessive energy expenditure to dislodge the flies.[5] Based upon studies evaluating these production losses, the generally accepted economic threshold for infestations of horn flies is 50 flies per animal[6] in a confined space.

$1 BILLION PER YEAR COST OF HORN FLIES TO THE NORTH AMERICAN CATTLE INDUSTRY

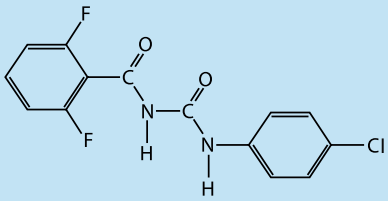
Horn flies take up to 30 blood meals per day causing irritation and affecting cattle comfort.

3 Kirkpatrick, John G., DVM, Lalman, David, Dr., "Pinkeye in Cattle Infectious Bovine Keratoconjunctivitis (IBK)", Oklahoma Cooperative Extension Service.

4 http://www.csress.usda.gov/nea/biotech/pdf/highlights_2002_no3.pdf
5 Byford, R.L., Craig, M.E., Crosby, B.L., A Review of Ectoparasites and Their Effect on Cattle Production, J. Anim. Sci., 1992, 70:597-602.
6 P. G. Koehler, J. F. Butler and P. E. Kaufman. Pub# ENY-285 (IG137), Entomology and Nematology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences,University of Florida. Revised: December 2005. www.edis.ifas.ufl.edu/ig137.

CHEMICAL CHARACTERISTICS

Diflubenzuron is a chitin inhibitor. Chemical Family = substituted urea

CHEMICAL NAME:	N-[[(4-chlorophenyl) amino] carbonyl] -2, 6-difluoro-benzamide		
Technical Name:	Diflubenzuron	Empirical Formula:	$C_{14}H_9Cl\ F_2N_2O_2$
CAS Number:	65367-38-5	Properties:	White crystalline solid Soluble in Organic Solvents No Odor
Chemical Structure:			

ENVIRONMENTAL & ECOLOGICAL FATE

PERSISTENCE & MOVEMENT IN THE ENVIRONMENT

Diflubenzuron appears to be relatively non-persistent and immobile in the environment. It rapidly binds with soil particles and organic matter and is quickly broken down by soil biota. The half-life is approximately 2 days in aerobic soil. Diflubenzuron is stable to hydrolysis and photolysis. Available data indicate that it is unlikely that diflubenzuron will contaminate ground or surface water.

FATE IN PLANTS

When foliarly applied at the rate registered or proposed for use on citrus, soybeans and cotton, diflubenzuron undergoes very little, if any translocation from treated areas.

ACUTE, SUBCHRONIC AND CHRONIC TOXICITY OF DIFLUBENZURON IN ANIMALS

Diflubenzuron is practically non-toxic to birds, small mammals, freshwater fish and marine/ estuarine fish. It is non-toxic to honey bees. It is very toxic to aquatic invertebrates.

DEVELOPMENT/REPRODUCTIVE TOXICITY TERATOGENICITY MUTAGENICITY

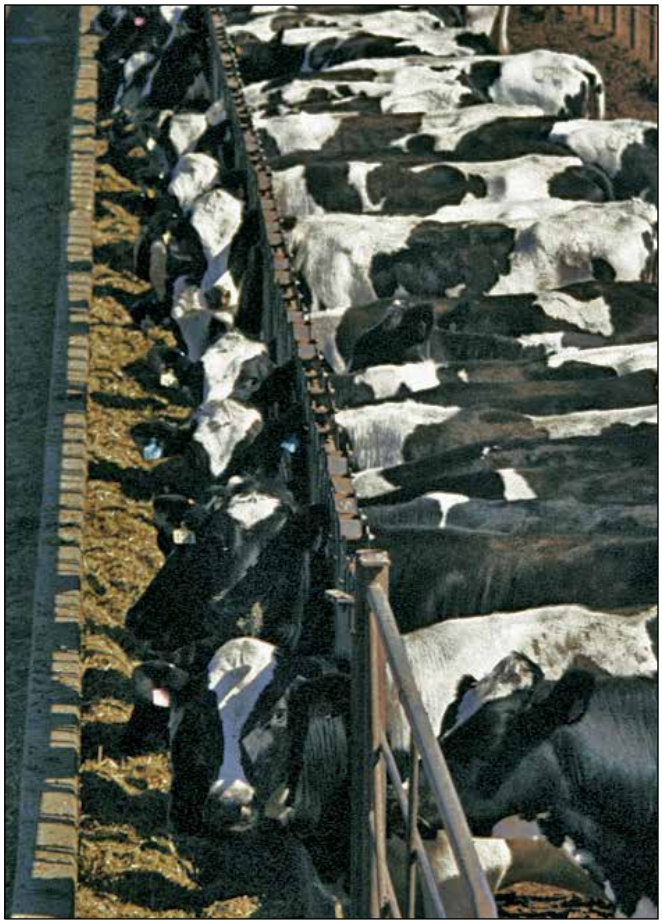
The EPA has determined that diflubenzuron is not a carcinogen. The NOEL (No-Observed Effect Level) for maternal and fetal toxicity in rats and rabbits was →1000 mg/kg/day. The NOEL for reproductive effects in rats was 250 mg/kg/day. Diflubenzuron is not a mutagenic compound.

SAFETY STUDIES

Sufficient data has been reviewed to support EPA registrations of products containing diflubenzuron and to establish acceptable tolerances. Established residue levels have been set for diflubenzuron in or on the following commodities: cottonseed, pasture, grass, soybeans, soybean hulls, milk, eggs and the meat, fat, and meat by-products of cattle, goats, hogs, horses, sheep and poultry.

METABOLISM IN CATTLE

The metabolism of diflubenzuron in cattle has been extensively studied in beef and dairy cattle. The EPA has established tolerances for milk, animal fat, meat and meat by-products at 0.05 ppm. Metabolism studies in dairy cows showed no detectable levels of diflubenzuron residues in milk when dosed for up to 28 days. In studies of beef cattle and dairy cows, very low levels of residues were occasionally seen in liver, kidney, fat and muscle.



EFFECTS ON HORSES

Accidental exposure of horses to ClariFly® Larvicide via cattle feed would not be anticipated to pose any toxicological risk. While another formulation of diflubenzuron is approved for equine use, ClariFly® Larvicide is not labeled for feeding to horses and it is a violation of federal law to use a product for a use that is not on the label.

REGULATORY STATUS OF DIFLUBENZURON

Diflubenzuron is a larvicide with activity against flies (house, stable, face, and horn) and many leaf eating larvae of insects feeding on agricultural, forest and ornamental plants (gypsy moths and rust mites). The active ingredient, diflubenzuron, was first registered by the EPA in 1976. Diflubenzuron has completed an extensive reregistration process, resulting in the publication by the EPA of the Reregistration Eligibility Document (RED) in 1997.

REGULATORY STATUS OF CLARIFLY® LARVICIDE

ClariFly® Larvicide was registered by the EPA in 2006 as the first diflubenzuron cattle product for use in feed. The following excerpt from the 2014 Feed Additive Compendium summarizes the regulatory status of the use of diflubenzuron in cattle feed. "FDA Status: No feed mill license required, product is a food additive. When used in medicated feeds, medicated feed application requirement is determined by regulatory status of the drug. EPA Status: Product is a pesticide when used in non-medicated feeds. EPA registration is required for feeds offered for sale except when custom-blended per the provisions of 40 CFR 167.3. In medicated feeds, the product is a feed additive and no EPA registration is required when the source of diflubenzuron is an EPA-registered product."

GET SEASON-LONG FLY CONTROL WITH CLARIFLY® LARVICIDE

Start using ClariFly® Larvicide in your feed mix early in the spring before flies begin to appear. Continue feeding ClariFly® Larvicide through the summer and into the fall, until cold weather reduces or ends fly activity.

INTEGRATED PEST MANAGEMENT (IPM) WITH CLARIFLY® LARVICIDE

ClariFly® Larvicide is even more effective as part of an IPM program. Practicing good sanitation, maintaining building repairs and utilizing baits and traps such as those in the Starbar® line of products, in conjunction with ClariFly® Larvicide can significantly decrease fly populations throughout a cattle operation.

Fly free cattle are comfortable cattle. They stay on feed and are more productive. So, adding ClariFly® Larvicide to feed as part of an IPM program can actually increase an operation's bottom line.

FEEDING LEVELS

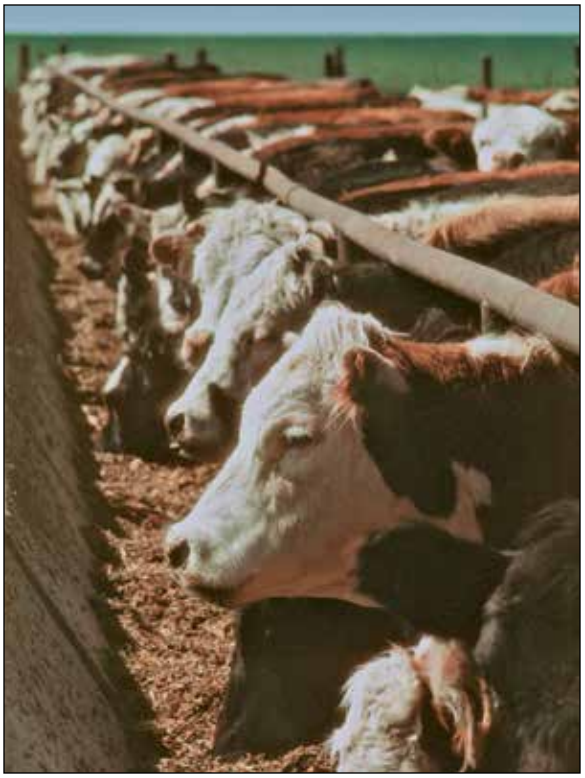
To control manure-breeding flies, all cattle on the premises need to consume adequate quantities of ClariFly® Larvicide every day. The feeding level for this product is 0.10 mg of diflubenzuron per kg of body weight per day, except for calves weighing 100-200 pounds.

For calves ‹200 lbs., please follow the recommended feeding rate chart below to ensure calves receive the full benefits of ClariFly® Larvicide.

Calf Weight (lb)	Feed Intake lb/head/day	Grams of Diflubenzuron/Ton
100-150	1.0-1.4	13.6
100-170	1.5-1.7	10.9
100-200	≥1.8	9.1

Daily consumption of ClariFly® Larvicide by individual animals may vary. However, fly control will not be affected.

Feeds and supplements containing ClariFly® Larvicide may be fed up to slaughter and to lactating dairy cows without withholding the milk from market during or after treatment.



LAB & FIELD STUDIES

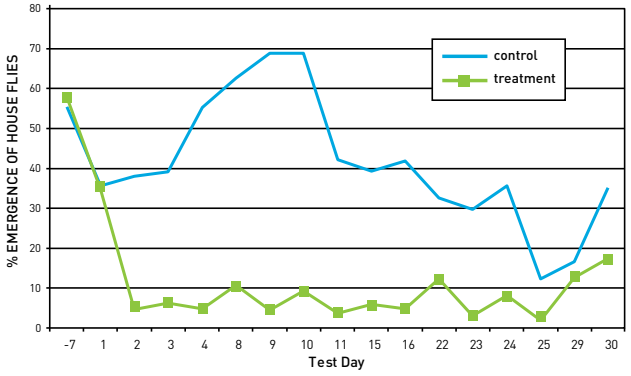
EFFICACY SUMMARIES

Efficacy studies have been conducted to show the effect of ClariFly® Larvicide on reducing the number of flies developing in the manure of cattle fed at the label rate of 0.10 mg/kg/day.

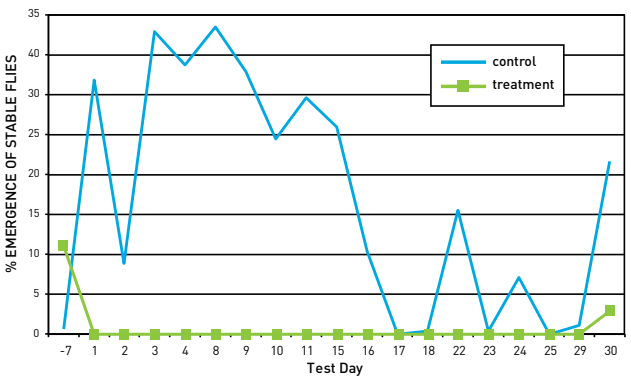
KANSAS STATE UNIVERSITY (LAB ASSAY)

Kansas State University conducted lab bioassays to show the percent emergence of house and stable flies developing in manure collected from animals consuming diflubenzuron (ClariFly® Larvicide) vs. untreated animals. Six mixed-breed beef steers were randomly assigned to either the treatment or control groups. Both groups were fed a 2 lb concentrate with no fly control feed-through for a 7 day acclimation period. At the end of the acclimation period (Day 0), diflubenzuron, at the target rate of 0.10 mg/kg of body weight, was incorporated into the treatment group's daily concentrate. The control group continued to receive the untreated concentrate. Fresh manure samples were collected daily from both groups of animals and seeded with either house fly or stable fly eggs. The percent emergence for both fly species are shown in Graph 1 (house fly) and Graph 2 (stable fly).

Graph 1. Beef Cattle Fed 0.1 mg/kg body weight DFB in Ration Concentrate at 2 lbs/day



Graph 2. Beef Cattle Fed 0.1 mg/kg body weight DFB in Ration Concentrate at 2 lbs/day

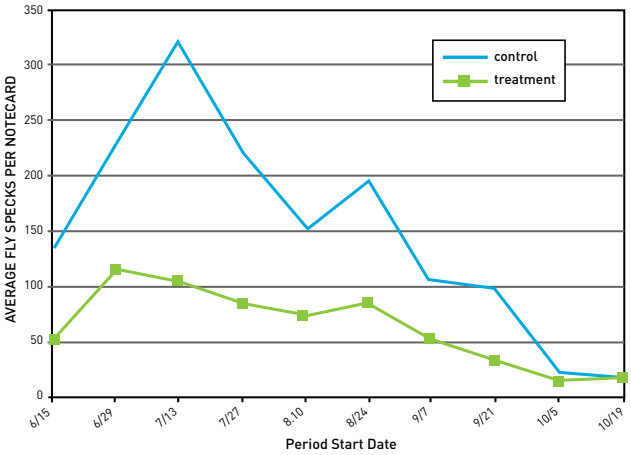


MINER INSTITUTE STUDY (FIELD EVALUATION)

The objective of this study was to determine the effects of ClariFly® Larvicide on field populations of house and stable flies when compared to traditional fly control programs. Twelve 200 – 500 cow dairy farms were chosen to participate in the study. Six serving as treated dairies were paired with six serving as control dairies. Treated dairies were asked to discontinue all other fly management practices other than the inclusion of ClariFly® in rations. Control dairies were allowed to continue their regular fly management program excluding the use of any feed-through products.

Fly speck cards were used to monitor fly populations during this trial. Below is a graph that shows the average fly specks per notecard from the lactating cow housing on treated dairies when compared to the control dairies.

Graph 3.



Average fly specks per notecard 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.)

SUMMARY OF LAB BIOASSAY EVALUATING THE EFFICACY OF DIFLUBENZURON FOR CONTROL OF HOUSE FLIES DEVELOPING IN MANURE OF CATTLE FED CLARIFLY® LARVICIDE.

A lab study was conducted in the fall of 2007 to evaluate efficacy of diflubenzuron to prevent the development of house flies in the manure of cattle fed ClariFly® Larvicide at the label rate of 0.10 mg diflubenzuron/kg of body weight/day. Study animals were weighed and randomly assigned to one of two treatment groups. Individual treatment doses were prepared for each animal in the ClariFly® Larvicide treated group for the entire 10 day test period (study day 0 – 9). Cattle in the untreated control group received placebo unit doses. Each animal was fed the individual dose each morning beginning on day 0. Manure was collected from each animal beginning on study day 3 and continuing through study day 9. Three replicates of manure from each animal from each day were seeded with 25 first instar house fly larvae from a laboratory maintained house fly colony. Bioassay cups were sealed individually in paper bags and maintained in a temperature and humidity controlled environment for a period sufficient for fly development and subsequent death. Counts of adult flies from each bioassay cup were recorded.

The diflubenzuron treated group provided an average of 96.7% reduction of successful house fly development and emergence from manure when compared to the untreated control group over the seven days that manure was collected. (Table 1)

TABLE 1: EFFICACY BY TREATMENT DAY

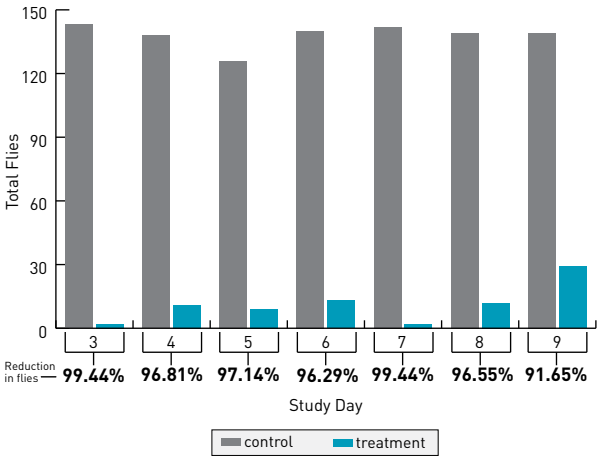
Study Day	Untreated Control Group Total Pupae	Avg. Pupae	Total Flies	Avg. Flies
3	145.00	24.17	143.00	23.83
4	140.00	23.33	138.00	23.00
5	126.00	21.00	126.00	21.00
6	140.00	23.33	140.00	23.33
7	142.00	23.67	142.00	23.67
8	139.00	23.17	139.00	23.17
9	139.00	23.17	139.00	23.17

Study Day	ClariFly® Treatment Group Total Pupae	Avg. Pupae	Total Flies	Avg. Flies	% Reduction
3	20.00	1.33	2.00	0.13	**99.44%**
4	28.00	1.87	11.00	0.73	**96.81%**
5	25.00	1.67	9.00	0.60	**97.14%**
6	23.00	1.53	13.00	0.87	**96.29%**
7	17.00	1.13	2.00	0.13	**99.44%**
8	24.00	1.60	12.00	0.80	**96.55%**
9	38.00	2.53	29.00	1.93	**91.65%**

Average number of pupae, adult flies and percent reduction of emergence in the ClariFly® Larvicide treatment group by study day. For full study data go to centralflycontrol.com

The formula used to calculate percent of efficacy for the treated groups corrects for a natural mortality of insects in a control group. Graph 4 illustrates the percent reduction of successful house fly development and emergence in the ClariFly® Larvicide treatment group.

Graph 4. Percent reduction of development and emergence of house flies developing in manure of cattle fed ClariFly Larvicide at label rate.



This study confirms that diflubenzuron provides control of house flies developing in manure from treated cattle fed ClariFly® Larvicide at the label rate of 0.10 mg of diflubenzuron/kg of body weight/day.

WEST TEXAS A&M STUDY

A feedlot study was conducted at West Texas A&M University to evaluate the growth performance and carcass characteristics of feedlot heifers when fed ClariFly® Larvicide. The objectives were to determine whether the inclusion of ClariFly® Larvicide in a feedlot ration would impact palatability, feed intake, average daily gain, and/or feed efficiency. Additionally, carcass data was collected to determine whether the inclusion of ClariFly® Larvicide would impact carcass characteristics, such as, carcass weight, dressing percentage, ribeye area, yield grade fat thickness and/or marbling scores. Being that the main focus of this study was to evaluate performance and carcass characteristics as opposed to fly control, it was conducted for 164 days beginning in September 2007 and concluding in February of 2008 when flies are typically not present.

A total of 180 crossbred heifers obtained from auction barns and grown for approximately 60 days were weighed, blocked by weight and assigned to one of two treatment groups receiving either untreated or treated rations. Each treatment group received a 91% concentrate finishing ration that included Rumensin®, Tylan® and MGA®. The treated ration included ClariFly® Larvicide added to deliver 0.10 mg of diflubenzuron/kg of body weight /day.

Treatments were randomly assigned to pens and heifers were randomly placed within each block after weights were taken. Heifers were housed in 18 pens (10 head/pen) that allowed 12 inches of bunk space per animal. Diets were prepared twice daily and bunks were managed to contain traces of refused feed each morning which was collected and recorded to obtain accurate daily consumption records per pen.

Effect of ClariFly® Larvicide on growth performance and carcass characteristics of finishing heifers.

Item	TREATMENT[a]		SE[b]	Observed Significance Level
	Control	ClariFly® Larvicide		
Pens	**9**	**9**	**-**	**-**
Animals	**90**	**90**	**-**	**-**
Days on feed	**164**	**164**	**-**	**-**
Initial weight, lb	**723**	**724**	**22**	**-**
Final live weight, lb	**1154**	**1154**	**28**	**-**
Final carcass-adjusted wt, lb[c]	**1154**	**1155**	**31**	**-**
Day 1 to end				
Dry matter intake, lb/d	17.27	17.20	0.47	0.84
Daily gain, lb/d, live basis	2.62	2.63	0.06	0.90
Feed efficiency, live basis	6.59	6.55	0.09	0.48
Daily gain, lb/d, carcass basis[c]	2.62	2.63	0.07	0.84
Feed efficiency, carcass basis[c]	6.60	6.54	0.09	0.62
Hot carcass weight, lb	**757**	**757**	**21**	**0.94**
Dressing percent	**65.50**	**65.60**	**0.30**	**0.82**
Ribeye area, sq.in.	**14.00**	**14.10**	**0.20**	**0.89**
Yield grade	**2.95**	**2.83**	**0.12**	**0.49**
12th rib fat thickness, in	**0.66**	**0.63**	**0.02**	**0.36**
Marbling score[d]	**484**	**493**	**9**	**0.44**

a Control = 91% concentrate diet, ClariFly = 91% concentrate diet containing 716 g of ClariFly/ton of DM
b Standard error of the least squares mean, n=9.
c Adjusted weight was calculated as actual final live weight with 4% shrink divided by the overall average dressing percentage (65.55). Carcass-adjusted daily feed efficiency were calculated using carcass-adjusted final weight.
d Select = 300 to 399, low Choice = 400 to 499, etc.

FOR COW COMFORT & BETTER RETURN ON YOUR INVESTMENT, USE CLARIFLY® LARVICIDE

Helps control house and stable flies in areas populated by beef and dairy cattle

Works as a feed-through, passing into manure where flies lay eggs

Can be used in IPM programs in conjunction with parasitoid wasps

ClariFly® LARVICIDE

For more information, contact your feed dealer, visit www.CentralFlyControl.com or call 1-800-347-8272.