EFFICACY REVIEW
F793 INSECTICIDE; EPA File Symbol: 270-GGO

DATE: **07/20/04**

DP BARCODE: D304898

GLP: No

CHEMICAL: Diflubenzuron (0.24%)

CHEMICAL NUMBER: 108201

PURPOSE: Provide efficacy data to support product registration.

MRID:

46230601. Pennington, R. (2003) Preliminary Efficacy of Diflubenzuron as an Oral Larvicide Treatment for Control of Fly Larvae in Manure of Treated Horses. Project Number: F793S54, F793R54. Unpublished study prepared by Kansas State University, Ecto Development Corp and Aldrich Quarter Horses. 54p.

46230602. Pennington, R. (2003) Second Preliminary Efficacy Study of Diflubenzuron as an Oral Larvicide Treatment for Control of Fly Larvae in Manure of Treated Horses. Project Number: F793R55, F793S55. Unpublished study prepared by University of Florida, Kansas State University and Ecto Development Corp 54 p.

46230603. Pennington, R. (2003) Efficacy of Different Doses of Diflubenzuron as an Oral Larvicide Treatment for Control of Fly Larvae in Manure of Treated Horses. Project Number: F793R56, F793S56. Unpublished study prepared by University of Georgia, Ecto Development Corp and Aldrich Quarter Horses. 46p.

462306-04. Pennington, R. (2003) Efficacy of Diflubenzuron as an Oral Larvicide Treatment for Control of Fly Larvae in Manure of Treated Horses. Project Number: F793R57, F793S57, 173/0036. Unpublished study prepared by University of Georgia, Insect Control and Research Inc and Ecto Development Corp 185p.

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BACKGROUND:

F793 Insecticide is an oral larvicide fed to horses for reducing fly populations in horse environments. This proposed product contains diflubenzuron and is intended to disrupt the developmental cycle of house and stable flies (*Musca domestica* and *Stomoxys calcitrans*) within horse manure, and is not efficacious against adults. F793 Insecticide should be fed top dressed on grain or mixed with the horse's total food ration to provide 6.8 mg of diflubenzuron per 100 lbs. of body weight, and should be administered early in the spring and continued throughout fly season, or until cold weather restricts fly flight. F793 Insecticide remains active within horse manure for up to 6 weeks, and should be used in conjunction with good management and sanitation practices. Proposed label claims include: "Breaks the fly life cycle", "Prevents emergence of adult House flies and Stable flies from manure of treated horses", and "Can be used as part of an integrated fly control pest management program."

DATA REVIEW:

The following data review is comprised of explanations of materials and methods, and a summation of experimental results containing tables with reformatted data.

46230601. Pennington, R. (2003) Preliminary Efficacy of Diflubenzuron as an Oral Larvicide Treatment for Control of Fly Larvae in Manure of Treated Horses. Project Number: F793S54, F793R54. Unpublished study prepared by Kansas State University, Ecto Development Corp and Aldrich Quarter Horses. 54p.

This study was comprised of two treatment groups and one control group. A single horse was tested in each of the three groups. The first treatment group used 0.16% diflubenzuron horse feed pellets produced using 90% diflubenzuron technical, while the second treatment group used 0.16% diflubenzuron pellets produced with 36.4% diflubenzuron premix granules. Both groups weighed their perspective horse and characterized their test substance to deliver a dose of 0.08 mg diflubenzuron per kg body weight per day, which was then administered as a top dressing on a daily ration of four pounds of feed supplement pellets. The horse within the control group was fed four pounds of the same supplement pellets, minus the insecticide.

The study ran for a total of eight consecutive days, and post-treatment manure samples were taken from each of the three groups on day seven (based on a scale of days 0-7). One hundred grams of manure was placed atop clean, fine sand in the bottom of six different plastic cups for all three groups. Thirty house fly or stable fly eggs were added to each of the three cups for each group. All cups were then covered and kept in a climate-controlled environment. Observations on adult fly emergence were taken. Pretreatment manure samples were taken prior to the initiation of the study, and were also tested using the same methods described above. All bioassays were conducted at Kansas State University.

Reported Results:

Treatment group A, which used test substances formulated with 90% diflubenzuron technical powder, showed an average of 83% reduction in adult house fly emergence, based on pretreatment and post-treatment counts. When testing for the stable fly, no adults emerged, however due to poor pretreatment emergence this data is considered inconclusive.

Treatment group B, which used test substances formulated with 36.4% diflubenzuron granules, showed an average of 92% reduction in adult house fly emergence, based on pretreatment and post-treatment counts. When testing for the stable fly, there was a 100% reduction in fly emergence, however due to poor pretreatment emergence this data is considered inconclusive.

Table 1. Pretreatment & Post-Treatment House Fly Bioassays (using methods at Kansas State University)

Horse	Pretreatment Emergence Average	Post-Treatment Emergence Average	% Reduction Average
Untreated	22	24	- 9%
Treatment A	24	4	83%
Treatment B	26	2	92%

Table 2. Pretreatment & Post-Treatment Stable Fly Bioassays (using methods at Kansas State University)

Horse	Pretreatment Emergence Average	Post-Treatment Emergence Average	% Reduction Average
Untreated	17	17	0%
Treatment A	0	0	-[i]
Treatment B	2	0	100%[i]

i. inconclusive data due to low pretreatment fly emergence

46230602. Pennington, R. (2003) Second Preliminary Efficacy Study of Diflubenzuron as an Oral Larvicide Treatment for Control of Fly Larvae in Manure of Treated Horses. Project Number: F793R55, F793S55. Unpublished study prepared by University of Florida, Kansas State University and Ecto Development Corp 54 p.

The primary materials and methods used within the second preliminary study were consistent with those used within the first study previously described, with the exception that the two 0.16% diflubenzuron formulations were fed to the horses at a dose of 0.10 mg pure diflubenzuron per kg of body weight. In addition, the preweighed test samples for both treatment group A & B were fed to the horses in feed tubs following consumption of morning grain ration rather than as a top dressing as was delivered in the preliminary study.

The study ran for a total of eight consecutive days, and post-treatment manure samples were taken from each of the three groups on days one and seven. Bioassays were conducted by both the USDA and University of Kansas. Bioassays conducted by the USDA consisted of four replicates of fifty first instar house or stable flies being introduced into beakers containing sampled manure. All beakers were covered and stored in a climate-controlled environment, and observations on adult fly emergence were taken. Bioassays conducted by University of Kansas were completed using similar methods with the exception of replacing the introduction of larvae with 30 fly eggs. Pretreatment manure samples were taken prior to the initiation of the study, and were bioassayed using 30 first instar larvae per container.

Reported Results:

Treatment group A, which used test substances formulated with 90% diflubenzuron technical powder, showed an average of 74% reduction in adult house fly emergence, based on pretreatment and post-treatment counts. When testing for the stable fly, there was a 100% reduction in fly emergence.

Treatment group B, which used test substances formulated with 36.4% diflubenzuron granules, showed an average of 93% reduction in adult house fly emergence, based on pretreatment and post-treatment counts. When testing for the stable fly, there was a 100% reduction in fly emergence.

Table 3. Pretreatment & Post-Treatment House Fly Bioassays (using methods conducted at United States Department of Agriculture and Kansas State University).

Horse	Pretreatment Emergence Average	Post-Treatment Emergence Average (day 7) (USDA/KSU)	% Reduction Average (USDA/KSU)
Untreated	27	49 / 10	- 82% / 63%
Treatment A	27	7 / 0	74% / 100%
Treatment B	26	2 / 0	93% / 100%

Table 4. Pretreatment & Post-Treatment Stable Fly Bioassays (using methods conducted at United States Department of Agriculture and Kansas State University).

Horse	Pretreatment Emergence Average	Post-Treatment Emergence Average (day 7) (USDA/KSU)	% Reduction Average (USDA/KSU)
Untreated	23	49 / 11	- 113% / 52%
Treatment A	27	0 / 0	100% / 100%
Treatment B	25	0 / 0	100% / 100%

46230603. Pennington, R. (2003) Efficacy of Different Doses of Diflubenzuron as an Oral Larvicide Treatment for Control of Fly Larvae in Manure of Treated Horses. Project Number: F793R56, F793S56. Unpublished study prepared by University of Georgia, Ecto Development Corp and Aldrich Quarter Horses. 46p.

This study was designed to test the efficacy of a 0.129% diflubenzuron formulation, formulated with 90% diflubenzuron powder, when fed to horses at doses of 0.11, 0.12 and 0.13 mg pure diflubenzuron per kg of body weight per day. The experiment was comprised of three treatment groups and one control group, with all four groups containing one horse. Each of the four horses was randomly assigned one of the three doses or control. All three treatment groups were fed their specified dosage daily for eight consecutive days as administered as a top dressing to a five pound ration of supplement pellets. The control horse was fed the supplement pellets minus the test substance. Pretreatment manure samples were taken prior to the initiation of the study, while post-treatment samples were taken from each group upon completion (day 7).

All pre and post-treatment manure samples were bioassayed at the University of Georgia. Bioassays consisted of four replicates of 35 first instar house flies being introduced into cups containing 60g of sampled manure. All cups were then covered and placed in a climate-controlled environment, and observations on adult fly emergence were taken.

Reported Results:

All three test groups showed a reduction in adult house fly emergence, with treatment groups A, B, and C averaging 84%, 91%, and 68% respectively.

Table 5. Pretreatment & Post-Treatment House Fly Bioassays Testing Variable Doses (using methods at University of Georgia).

Horse	Pretreatment Emergence Average	Post-Treatment Emergence Average (day 7)	% Reduction Average
Untreated	33	33	0%
Treatment A (0.11mg)	32	5	84%
Treatment B (0.12mg)	34	3	91%
Treatment C (0.13mg)	34	11	68%

462306-04. Pennington, R. (2003) Efficacy of Diflubenzuron as an Oral Larvicide Treatment for Control of Fly Larvae in Manure of Treated Horses. Project Number: F793R57, F793S57, 173/0036. Unpublished study prepared by University of Georgia, Insect Control and Research Inc and Ecto Development Corp 185p.

This study was designed to test the efficacy of a 0.24% diflubenzuron formulation, formulated with 90% diflubenzuron powder, when fed to horses at doses ranging from 0.135 to 0.161 mg diflubenzuron per kg of body weight per day. The experiment was comprised of six treatment groups and two control groups, with all eight groups containing one horse. All horses were fed their specified dosage daily for eight consecutive days (days 0-7) as administered as a top dressing to their daily ration of supplement pellets. The control horses were fed the supplement pellets minus the test substance. Pretreatment manure samples were taken prior to the initiation of the study, while post-treatment samples were taken from each group upon completion (day 7).

Pre and Post-treatment manure samples were bioassayed at both the University of Georgia and Insect Control Research. Bioassays conducted at the University of Georgia consisted of four replicates of 35 house/stable fly larvae being introduced into cups containing 60g of sampled manure. All cups were then covered and placed in a climate-controlled environment, and observations on adult fly emergence were taken. Bioassays completed at the Insect Control Research were conducted in a similar manner, with the exception of the use of fly eggs rather than larvae.

Reported Results:

The percent reduction of adult house fly emergence for the manure bioassayed at the

University of Georgia ranged from 28% (treatment A; 0.135mg) to 55% (treatment E; 0.160mg), while the manure bioassayed at Insect Control Research ranged from 82% (Treatment A; 0.135mg) to 100% (Treatment E; 0.160mg).

The percent reduction of adult stable fly emergence for the manure bioassayed at the University of Georgia ranged from 86% (treatment C; 0.143mg) to 100% (Treatment E; 0.160mg and Treatment F; 0.161mg), while the manure bioassayed at Insect Control Research ranged from 0% (treatment C; 0.143mg) to 100% (Treatment E; 0.160mg and Treatment F; 0.161mg). Due to low stable fly emergence from pretreatment samples bioassayed at Insect Control Research, data recorded for treatment groups C (0.143mg) and D (0.154mg) and both untreated groups are considered inconclusive.

Table 6. Pretreatment & Post-Treatment House Fly Bioassays (using methods conducted at University of Georgia and Insect Control Research).

Horse	Pretreatment Emergence Average (U. of G.A. / I.C.R.)	Post-Treatment Emergence Average (U. of G.A. / I.C.R.)	% Reduction Average (U. of G.A. / I.C.R.)
Untreated A	32 / 25	34 / 26	- 6% / - 4%
Untreated B	33 / 26	33 / 26	0% / 0%
Treatment A (0.135mg)	32 / 28	23 / 5	28% / 82%
Treatment B (0.140mg)	34 / 28	23 / 4	32% / 86%
Treatment C (0.143mg)	32 / 27	6 / 3	81% / 89%
Treatment D (0.154mg)	31 / 28	19 / 1	39% / 96%
Treatment E (0.160mg)	33 / 28	15 / 0	55% / 100%
Treatment F (0.161mg)	34 / 27	17 / 1	50% / 96%

Table 7. Pretreatment & Post-Treatment Stable Fly Bioassays (using methods conducted at University of Georgia and Insect Control Research).

Horse	Pretreatment Emergence Average (U. of G.A. / I.C.R.)	Post-Treatment Emergence Average (U. of G.A. / I.C.R.)	% Reduction Average (U. of G.A. / I.C.R.)
Untreated A	27 / 0[i]	30 / 11	- 11% / -[i]
Untreated B	21 / 2[i]	33 / 10	- 57% / - 400%[i]
Treatment A (0.135mg)	30 / 27	2 / 1	93% / 96%
Treatment B (0.140mg)	32 / 21	3 / 0	91% / 100%
Treatment C (0.143mg)	29 / 2	4 / 2	86% / 0%[i]
Treatment D (0.154mg)	21 / 0[i]	2 / 1	91% / -[i]
Treatment E (0.160mg)	27 / 16	0 / 0	100% / 100%
Treatment F (0.161mg)	30 / 22	0 / 0	100% / 100%

i. inconclusive data due to low pretreatment fly emergence

RECOMMENDATIONS:

The submitted data does not support product registration for the following reasons:

1. There is not enough data showing that this product is efficacious at the labeled recommended dose rate of 6.8 mg of a.i. per 100 lbs. of body weight (0.15 mg of a.i. per kg of body weight) to support product registration. Of the four submitted studies, only one used the recommended dose (.154 mg). From this one treated horse, four different groups of bioassays were taken, with each introducing either house fly eggs, house fly larvae, stable fly eggs, or stable fly larvae. Of the four, only two (house fly eggs and stable fly larvae) were effective at substantially reducing adult fly emergence. Bioassays using house fly larvae resulted in reducing emergence by only 39%, while bioassays using stable fly eggs had inconclusive data as a result of low pretreatment counts. Additional studies using a minimum of ten horses treated with the recommended daily dose rate need to be submitted.

2. As specified on the label, the recommended method of application is to top dress or mix with the horse's total grain ration. Three of the four submitted studies applied the test substance as recommended, however one study (462306-02) fed the horses the product in feed tubs after consumption of the morning grain ration. It is necessary that all future studies administer the product as instructed on the label.

3. Depending upon the study, and the institution responsible for conducting the bioassays, some tested dose rates introduced either fly eggs, fly larvae, or both. Future submitted studies should use both eggs and larvae.

4. The following proposed label claims must have supportive data submitted or be removed from the label: "Prevents emergence of Stable flies and House flies from treated manure for up to (6 weeks) (42 days) (1 ½ months)" and "Offers the same level of efficacy with 90% less active ingredient than (the original) Equitrol".