DATA EVALUATION RECORD

1. Chemical: Cyhalothrin

2. Test Material: Cyhalothrin 92.2% w/w

Chemical Structure: (R,S) -cyano-3-phenoxy benzyl (±)-cis-3, 3(Z-2-chloro-3,3,3-trifluoroprop-1-en)-2,2-dimethylcyclo-propanecarboxylate
cis:trans ratio: 96.8:3.2

3. Study Type: Avian Reproduction

Species Tested: Bobwhite Quail (Colinus virginianus)

4. Study ID: Roberts, N.L., Fairley, C., Chanter, D.O., McAllister, A., and Almond, R.H. (1982) The Effect of the Dietary Inclusion of Cyhalothrin on Reproduction in the Bobwhite Quail. Prepared by Huntingdon Research Centre, Huntingdon, England - PE 18 6ES; Submitted by ICI Americas, Inc. EPA Accession No. 073989.

5. Reviewed By: Candy Brassard
EEP/HED

Signature: Candy Brassard

Date: 3-7-88

6. Approved By: Douglas J. Urban
Head-Section III
EEB/HED

Signature: Douglas J. Urban

Date: 3/10/88

7. Conclusion:

Based on the submitted data it appears that cyhalothrin does not cause reproductive impairment for the number of eggs laid, eggs set, viable embryos, live embryos, normal hatchlings and 14-day survivors at ≤ 50 ppm Cyhalothrin. The statistical analysis indicated the NOEL was ≤ 50 ppm cyhalothrin for eggs cracked as well, however, the percent eggs cracked (and damaged) was reported to be as high as 17 percent for the control. Therefore, the results for this parameter appears to be unreliable. The study appears to be scientifically sound, however there are data discrepancies that cause concerns.

8. Recommendations:

The study author/company should satisfy discrepancies outlined in section 14A. Specifically, the cause for high percent eggs cracked for the control should be addressed.

9. Background:

The study was submitted to support registration of Karate or PP321 on cotton and soybeans.

10. Discussion of Individual Tests: N/A

11. Materials and Methods:

a. Test Animals - Young adult bobwhite quail that were approaching first laying season, were obtained from Lincolnshire Pheasantries Limited, Boston, Lincolnshire. The birds were acclimated for over 2 months prior to dosing. A total of 51 males and 102 females were used in the study.

b. Test System - Adults - (excerpted from submission)

Adult birds were housed in treatment replicate groups each consisting of one male and two females. The groups were housed in tiered cages of polythene coated steel wire, each measuring approximately 31.5 cm x 38.5 cm x 24 cm. Each cage contained a stainless steel food hopper and a nipple drinker and had a sloping floor with a 10 cm egg catcher. The maximum and minimum ambient temperature together with the relative humidity was recorded daily throughout the study, with the following values:

	Mean	Range
Relative humidity (%)	67	48 to 85
Maximum temperature (°C)	18	10 to 25
Minimum temperature (°C)	14	8 to 22

Ventilation fans were adjusted as necessary. The following controlled artificial lighting pattern was adopted:

Days of study	Hours light	Hours dark
1 to 70	7	17
71 to 77	8	16
78 to 91	9	15
92 to 98	12	12
99 to 105	13	11
106 to 217	14	10

The birds were fed both basal diet with and without test compound. The diet consisted of the following ingredients:

Ingredient	% w/w
Ground wheat	38.25
Ground maize	30.00
Weatings (Wheatfeed)	5.00
Provimi 66 fishmeal	10.00
Soya bean meal	10.00
Limestone flour	5.50
Pantoribin 537*	1.25

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* Mineral, vitamin and trace element supplement (B.P. Nutrition (U.K.) Ltd.).

Water was available ad libitum from nipple drinkers.

Diet Preparation - The test substance was mixed with corn oil in the final diet. Corn oil at a final rate of 0.1% w/w, was incorporated in treatment as well as the control diets. Diets were mixed on a daily basis. Residue analysis was conducted on the diet to test for stability and homogeneity. Throughout the report, nominal concentrations of cyhalothrin are given.

Eggs - Eggs were incubated on a weekly interval using a Western Incubator. The temperature and humidity were recorded daily as follows: Temperature - 37.7 °C (mean) and humidity ranging from 34 to 69 percent with mean 63.0 percent. Eggs were turned every 45 minutes through an angle of 90° throughout the incubation period. Eggs were incubated for approximately 20 days before transferred to hatcher.

Hatching - The hatchers were Air Bristol Incubator models PH 90 and PH 150, which operated at 37.5 °C. Hatcher trays were made from wooden frames with wire mesh floors. Chicks hatched 24 to 26 days after eggs were first set in the incubator.

Chicks - (following excerpted from submission)

Chicks were housed in wooden pens with concrete floors. Each pen contained two drinkers and two food hoppers. Wood shavings, supplied by the Sawdust Marketing Company Limited, were used as bedding. Each pen contained two 300 watt infra-red lamps placed at bird level to supply additional heat to the chicks. The minimum and maximum ambient temperature together with the relative humidity were recorded once daily and had the following values:

Ingredient	% w/w
Ground wheat	38.25
Ground maize	30.00
Weatings (Wheatfeed)	5.00
Provimi 66 fishmeal	10.00
Soya bean meal	10.00
Limestone flour	5.50
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Water was available ad libitum from nipple drinkers.

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	Mean	Range
Relative humidity (%)	48	31 to 72
Maximum temperature (°C)	38	28 to 46
Minimum temperature (°C)	31	22 to 39

A continuous artificial lighting pattern was adopted for the chicks. Ventilation fans were adjusted as required.

Feeding - The chicks were given standard HRC chick diet in meal form made by Joseph Odam, Ltd., Eye Mill, Peterborough, Cambridgeshire, England.

Diet composition

Ingredient	% w/w
Ground wheat	30.00
Ground maize	25.00
Ground barley	10.00
Provimi 66 fishmeal	15.00
Extracted soya bean meal	13.75
Weatings (Wheatfeed)	5.00
Pantoribin 537*	1.25

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* Mineral, vitamin and trace element supplement (B.P. Nutrition (U.K.) Ltd.).

c. Dose - A control and two treatment levels were used - 5 ppm and 50 ppm cyhalothrin.

d. Design - There were 14 pens per treatment group, each containing two females and one male, a total of 28 females and 14 males per dose level. In addition, a number of spare birds (three males and six females per treatment group) were maintained on each of the three treatments for use as replacement birds if necessary during the pre-egg production period.

Observations -

Adult Bird Observations were as follows:

- Mortalities - daily.
- Bird health - daily.
- Gross mean food consumption - weekly per replicate.

- Individual body weights - days 0*, 14, 28, 42, 56, 70, 84, 98, 112, and 217.
- Gross macroscopic postmortem examination - all birds were examined postmortem for gross abnormalities.

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* At the start of day 1 immediately prior to the introduction of test diets.

Egg Observations were as follows:

- Egg collection - Eggs were collected daily throughout the 12-week egg production period.
- Egg weights - At 7-day intervals the collected eggs were weighed. Broken eggs were not weighed.

Egg Quality - Eggs cracked (and damaged) - At 7-day intervals the collected eggs were candled after weighing, to check for cracks and breakages. Any other shell abnormalities were noted at this stage.

Egg Shell Thickness - All eggs collected in the first 2 days of weeks 1, 3, 5, 7, 9, and 11 were examined. The eggs were cracked open at the widest point and the contents washed out with tap water. The shells were then "left to dry at room temperature for a minimum of 48 hours. The shell thickness of each egg was measured at four points around the circumference of the shell using a micrometer calibrated to 0.01 mm."

Incubation (excerpted from submission):

Incubation - All eggs remaining after the cracked, broken, abnormal eggs and those taken for shell thickness had been removed were placed in the incubator at weekly intervals.

Candling and Hatching (excerpted from submission):

The incubated eggs were examined at days 11 and 18 of the incubation period by passing over a light source in a darkened room (candling). The following parameters were recorded:

1. Infertile eggs - Appearing as "clears" at the Day 11 candling.

2. Early embryonic mortalities - At the Day 11 candling any embryos observed to be dead were removed. The embryos at this stage were not fully differentiated.

3. Late embryonic mortalities - At the Day 18 candling any embryos observed to be dead were removed. At this stage the embryos were fully differentiated.

4. "Dead in shells" - Any eggs which failed to hatch after the embryonic deaths and infertiles had been removed were recorded as "dead in shells." These eggs generally contained chicks which appeared to be fully formed and viable but failed to get out of the shell. Pipped eggs, i.e., chicks which had been able to crack the shell but had been too weak to get out, were also noted.

5. Chicks hatched - The chicks hatched alive were recorded. In addition, those which hatched but were found dead in the hatcher were also recorded. Any abnormalities were also noted at this stage.

Chicks - All chicks hatched alive were reared until they were 14 days old and the following parameters were recorded:

1. Individual bodyweight - Within 24 hours of hatching and 14 days later.

2. Bird health - Daily.

3. Mortalities - Daily.

4. Gross macroscopic postmortem examination - Only sporadic mortalities were examined for gross abnormalities. No examination was made at termination.

Summary of Study Duration (excerpted from submission):

Adults	19-week pre-egg production period 12-week egg production period.
Incubation	Eggs collected over the 12-week egg production period were incubated weekly. The incubation period lasted approximately 24 to 26 days.

Chicks — The weekly hatches of chicks from the 12-week egg production period were reared until they were 14 days old.

The total study duration from the start of the adult observation period to the final chick observations was approximately 36 weeks.

e. Statistical Analysis - (excerpted from submission)

A statistical analysis of the following responses was carried out:

1. Adult food consumption
2. Adult bodyweight
3. Number of eggs laid and proportion damaged
4. Egg weight
5. Egg shell thickness
6. Number of infertilities, embryonic mortalities and hatchings
7. Number of 14-day old surviving chicks
8. Chick bodyweights

12. Reported Results:

Mortalities and Bird Health

No evidence of any treatment-related response in the number of mortalities occurring in each group. Birds which died during pre-egg production period (Days 1 through 133) were replaced by sparebirds. No replacements were made during egg production period (Days 134 through 217). (See Table 1.)

Bird No. and Sex	Replicate/ Group	Day of Death	Replacement Bird No.
325M	9A	127	461M
338F	13A	76	462F
412M*	38A	98	446M
425F	42A	6	466F
322M	8B	35	467M
340M	14B	67	455M
310M	4C	22	452M
345F*	15C	9	453F

* Signs of "bullying" recorded prior to death.

Bird health observations are in Appendix 2.

Adult Body Weights - All body weights were within normal limits and no treatment-related effects were found. (See Table 2.)

Food Consumption - Food consumption was within normal limits in all groups throughout the study and no-treatment-related effects were observed. (See Tables 3 and 4.)

Gross Postmortem Examination - Sporadic mortalities. Two birds appeared to have died from bullying. Bird No. 412M (Replicate group 38A) and 345F (Replicate 15C).

Terminal Findings - Pale livers were noted in a number of birds during postmortem. This was observed in all groups and was not considered to be an abnormality.

The following observations were also made:

- Ovary underdeveloped - four in control, four in lowest dose level, and one in highest dose level.

- Testes underdeveloped - one in lowest dose and one in highest dose.

- Liver blotchy - five in control, one in each dose level (5 ppm and 50 ppm).

- Ovary developed but no eggs in oviduct - one in control, one in lowest dose level.

- Egg bound - one at highest dose tested.

Eggs Laid - The total number of eggs laid were similar for the control and lowest dose (5 ppm) and slightly higher for highest dose (50 ppm). Statistical analysis of the results showed no significant difference between treatments. (See Table 5.)

Eggs Cracked (and Broken) (excerpted from submission) - No significance differences between treatments were detected in the proportions of cracked and broken eggs. (See Table 6.)

Egg Weights (excerpted from submission) - Statistical analysis of the egg weight data showed that there were no significant differences between treatments in total egg mass or mean egg weights. (See Table 7.)

Egg Shell Thickness (excerpted from submission) - Egg shell thickness was within normal limits for both control and test groups and statistical analysis of the results showed no differences between treatments. (See Table 8.)

Infertile eggs (excerpted from submission) - The proportions of eggs incubated which were found to be infertile at Day 11 candling varied within treatment groups during the 12-week egg production period. Overall, the proportion of infertile eggs was lower in Group C (Cyhalothrin at 50 ppm) than in Groups A and B (Control and Cyhalothrin at 5 ppm). Statistical analysis of the results showed no significant differences between treatments. (See Tables 9 and 10.)

Early embryonic mortalities - The proportions of early embryonic mortalities occurring in fertile eggs were variable, but similar overall in all treatment groups. No significant differences between treatments were detected. (See Tables 9 and 10.)

Late embryonic mortalities - The proportions of late embryonic mortalities were small in all treatment groups. Statistical analysis of the results was not practicable. (See Tables 9 and 10.)

Hatching (excerpted from submission) - The proportions of fertile eggs which subsequently hatched were generally high and were similar overall in all groups. Statistical analysis of the results showed no significant treatment differences. (See Table 11.)

Chick Health and Mortalities (excerpted from submission) - Chick health was generally good and the numbers of mortalities occurring were within normal limits. Details of mortalities are given in Appendix 7.

The following observations on chick health were made:

Bird No.	Replicate/Group	Week of hatch	Observations
2G (blue)	19B	2	Sacrificed on Day 1 as very weak, with splayed legs.
62N (green)	38A	12	Bird subdued on Day 13, prior to death on Day 14.

Number of 14-Day Survivors (excerpted from submission) - The proportion of chicks surviving to 14 days was generally high in all groups and statistical analysis showed no significant differences between treatments. (See Table 12.)

Bodyweights (excerpted from submission) - All mean chick bodyweights at hatching and after 14 days were within normal limits and no statistically significant differences were found between treatments. (See Table 13.)

Postmortem Examination

No abnormalities other than those mentioned in chick health section, were detected in any chicks during postmortem examination.

13. Study Authors' Conclusions/QA Measures (excerpted from submission):

Under the conditions of this study there was no evidence that dietary administration of cyhalothrin at dose levels of 5 ppm and 50 ppm had any adverse effects on reproduction in the Bobwhite quail.

To the best of my knowledge and belief, this study was conducted in compliance with Good Laboratory Practice regulations as set forth in "Title 21, of the U.S. Code of Federal Regulations, Part 58", with the exception of possible minor items, none of which is considered to have an impact on the validity of the data or the interpretation of the results in the report. (Signed by N.L. Roberts.)

14. Reviewer's Discussion and Interpretation of the Study:

The following discrepancies were noted in the study:

a. Test Procedures - The percent cracked of eggs laid in the control is of real concern. Typically, 0.6 to 2.0 percent is seen and may be as high as 5-6percent, and this study author reported the percent cracked and damaged to be as high as 17 percent. The percentage eggs cracked, not including broken, was as high as 15.9 percent. While it is true that there is no statistically significant difference between the control and two treatment groups the percent eggs cracked of eggs laid in the control is considerably higher than the normal limit. No historical control data were submitted. Another study submitted by this Laboratory to EPA, specifically for Bifenthrin, reported 9 percent eggs cracked in the control (review completed by Les Touart on October 13, 1987). Rick Bennett with U.S. EPA Environmental Research Laboratory, Corvallis, OR, reported the percent eggs cracked for the bobwhite, with sloped cage facilities, to be less than 5 percent and usually only 1 to 2 percent. The study author should report the cause for such a high percent eggs cracked in the control, and should also submit the historical control data.

- Exact age not reported - only that the birds were approaching their first laying season.

- The percent calcium and phosphorous in the adult diet should be indicated.

- Typically, a 12 week pre-egg production period is used with bobwhite reproduction studies. The study author should indicate why a 19-week pre-egg production period was used.

- It was not reported if the adult diet was available ad libitum.

- The study author reported temperature ranges of 8 to 25 °C and relative humidity ranges of 48 to 85 percent. The recommended levels (McLane, D. 1986) are 21 °C and 55 percent relative humidity. The study author should account for the temperature variation.

- Provisions made to avoid food spillage were not reported.

- The study author did not indicate the size of chick pens.

- In appendix 5, week 1 for the control - Group A, there was a 32A for a replicate number. EEB is assuming that the study author intended it to read 38A. This should be clarified.

- The percent live embryos when compared to viable embryos should be around 97 to 99 percent. This study was reported to be as low as 94.2 percent for the control.

b. Statistical Analysis - The following parameters were evaluated using an ANOVA program and Duncan's multiple range test: eggs laid, eggs cracked, eggs set, viable embryos, live embryos, normal hatchlings, and 14-day-old survivors.

The results are as follows:

Eggs laid = NOEL > 50 ppm

Eggs cracked = NOEL > 50 ppm

Eggs set = NOEL > 50 ppm (These results may not be reliable.)

Viable embryos = NOEL > 50 ppm

Live embryos = NOEL > 50 ppm

Normal hatchings = NOEL > 50 ppm

14-day survivors = NOEL > 50 ppm

EEB analyzed the reproductive effects. (See Table A.)

c. Discussion/Results - The percent eggs cracked for the control is considerably high, even for sloped cage facilities. The study author should account for this discrepancy, along with submitting historical control data for this study. The study author should report the reason for such a wide variation in the temperature used for the accommodations of the birds. The study author should also indicate why the unusually long pre-egg production period was used. There are numerous other minor data discrepancies listed in section 14 of this review.

d. Adequacy of Study

1) Classification - Supplemental for 92.2% w/w cyhalothrin.

2) Rationale - This study appears to be scientifically sound; however, the data discrepancies outlined in 14.c. detract from the study.

3) Repairability - Repairability pending the data submitted to satisfy discrepancies outlined in Section 14.a. and c.

Table A

Analysis of Reproductive Effects

	Concentrations of Cyhalothrin		
	Control	5 ppm	50 ppm
Eggs laid	1280	1287	1345
Eggs laid/hen/season*	46.9	47.6	49.6
Eggs cracked**	217	211	277
Eggs cracked/hen/season	6.9	7.8	10.1
Percent of eggs laid	17%	16.4%	20.6%
Eggs set	963	967	966
Percent of eggs laid	75.2%	75.1%	71.8%
Viable Embryos (11-Day)	768	780	848
Percent of eggs laid	60%	60.6%	63.0%
Percent of eggs set	79.7%	80.6%	87.7%
Live 18-Day Embryos	724	714	804
Percent of viable embryos	94.2%	91.5%	94.8%
Hatchlings	664	660	732
Percent of eggs laid	51.8%	51.3%	54.4%
Percent of eggs set	69.0%	68.3%	75.8%
Percent of viable embryos	86.5%	84.6%	86.3%
Percent of 18-day embryos	91.7%	92.4%	91.0%
14-Day Survivors***	550	525	613
Percent of normal hatchlings	83%	80%	84%
Average hatchweight (g)	7	7	7
Average 14-Day-Old Survivors weight (g)	19	19	20
Adult Body Weight (g/Bird) (at study termination)			
Females	226	225	224
Males	209	205	208

	Control	5 ppm	50 ppm
Adult Body Weight (g/Bird)			
Increase compared to Day 0			
Females	+33	+33	+31
Males	+ 9	+ 6	+ 8
Mean Eggshell Thickness	0.195	0.19	0.198
Mean Egg Weight	10.0	10.0	10.0
Average Feed Consumption			
Pre-egg production period	17.2	17.1	18.0
Egg production period	22.1	24.3	25.3
Mean Total	19.1	19.9	20.8

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* The number of females per week were used to estimate number per pen. Therefore, the mortalities were included.

** Eggs cracked include all broken, damaged and cracked eggs.

***Number of survivors per hen could not be calculated since there were mortalities within each treatment level (and control).

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Pages 16 through 22 are not included in this copy.

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