

US EPA ARCHIVE DOCUMENT

Data Evaluation Record

1. CHEMICAL: Thiabendazole
2. FORMULATION: 98.% (Technical)
3. CITATION: Fink, R. (1978) One Generation Reproduction Study - Bobwhite Quail Thiabendazole 98.5% Technical Final Report;  
Submitted to Merck & Company, Inc. Rahway, New Jersey 07065 by Wildlife International Ltd. (Received 11/20/78. Accession No. 235974.)
4. REVIEWED BY: R.W. Matheny  
Wildlife Biologist  
Ecological Effects Branch/HED
5. DATE REVIEWED: August 29, 1979
6. TEST TYPE: Avian Reproduction *22 week*  
Test Species: Bobwhite Quail
7. REPORTED RESULTS: Thiabendazole 98.5% Technical, fed to mature bobwhite quail at dietary concentrations of 80 ppm and 400 ppm had no effect on the reproductive success of the birds throughout a one-generation reproduction study.
8. REVIEWERS CONCLUSIONS: The study is scientifically sound and demonstrates that Thiabendazole does not cause statistically significant reproductive impairment in upland game birds at the concentrations tested (80 ppm, 400 ppm). The study fulfills the requirement for an avian reproduction study on bobwhite quail.
9. MATERIALS/METHODS:

Test Procedures

One hundred and eight bobwhite quail (36 cocks and 72 hens) from Wildlife Internationals' production flock were used in this test. They were randomly distributed into the following test groups:

No.	Group	Dosage Level ppm	No. Pens	Quail/Pen	Cocks/Hens
1	Controls	0	12	1	2
2	Thiabendazole*	80	12	1	2
3	Thiabendazole*	400	12	1	2

\*98.5% Technical

Standard recognized procedures were used in the conduct of this avian reproductive study. The study birds were housed indoors with the photoperiod for the first six weeks averaging nine hours of light per day. It was increased to 17 hours for the 16 remaining weeks. Five footcandles of illumination was provided the birds throughout the study.

Other features of the test:

- (1) Body weights: recorded at initiation, after 5 weeks, prior to onset of egg laying, termination of study.
- (2) Food consumption: recorded biweekly
- (3) Eggs: collected daily; stored @ 60° F, 55% RH; candled on Day 0 of incubation; embryo viability measured on Day 14; embryo survival measured on Day 19; placed in hatcher on Day 19
- (4) Chicks: removed from incubator on Day 21 or Day 22; maintained on control diet until 14 days of age.
- (5) Temperature: 99.5° F ± 1° throughout incubation
- (6) Humidity Index: 87.0° F ± 1° throughout incubation
- (7) Eggshell thickness measurement: 1 egg/pen/group each week randomly selected & measured

Statistical Analysis

The student's t-test was used to evaluate various parameters, including:

- (1) eggs laid
- (2) eggs cracked
- (3) eggs set
- (4) viable embryos
- (5) live three-week embryos
- (6) hatchlings
- (7) body weights-representative hatchlings
- (8) 14-day-old survivors
- (9) body weights-representative 14-day-old survivors

Table 1

Reproductive Data Parameter	- Bobwhite Quail		
	Control	Thiabendazole (ppm)	
		80	400
Eggs Laid	619	747	672
Eggs Cracked	144	187	203
Eggs Set	433	514	425
Viable Embryos	389	369	383
Live Three-Week Embryos	386	349	376
Normal Hatchlings	286	238	275
14-Day-Old Survivors	271	221	258
Average Eggshell Thickness (mm)	0.210	0.213	0.205

Discussion/Results

Mortality		
Group	No. of Deaths	Time (weeks)
Control	None	-
80 ppm	1 hen*	16
400 ppm	2 hens*	13

\*According to the researcher, these mortalities occurred during the stress of egg production and no gross compound related abnormalities were noted upon necrosy. These deaths, therefore, were considered to be incidental and not compound related. Other birds in the three groups appeared normal.

Egg Production

This study is based upon the total eight weeks' egg production and egg set period.

Body weight

The mean bodyweight for bobwhite chicks was 7 grams for the control and both test groups. At 14 days of age the mean body weight for each of the groups was 24 grams, while the adult body weight after 17 weeks 226, 232 and 227 grams, respectively for the control, 80 ppm and 400 ppm groups.

TABLE 2

Average Food Consumption Per Bird During Study

Week	Level		
	Control	80 ppm	400 ppm
2	23 grams	22 grams	21 grams
6	18 grams	18 grams	16 grams
10	20 grams	21 grams	19 grams
14	19 grams	22 grams	20 grams
17	19 grams	21 grams	19 grams

A. Test Procedure

The test procedures generally comply with the recommended EPA 1978 protocol.

B. Statistical Analysis

A series of T-tests were conducted using the Comnet Computer within the EE Branch to check the hypothesis that the means of two groups of data are equal. Six parameters were compared (see data printout) and in only one (eggs cracked) was the mean variance shown to be unequal. This could have been attributed to the fact that the quail used in this study were not debeaked as is the normal practice for caged birds under study. The probability (F-statistic) for all other parameters compared is  $>0.05$ .

Since the T-test compares only two sets of data at one time, it was deemed appropriate to conduct the Anova test for this data. Using the TI-59 program in determining the mean and variance values for two parameters (see print-out attached), no significant difference was found. Duncan's analysis, therefore, was not conducted.

C. Discussion/Results

Thiabendazole, tested at 80 ppm and 400, ppm did not appear to cause any adverse effects upon the reproductive behavior of bobwhite quail. Statistically there were no significant differences between treated and controls.

TABLE 3

## REPRODUCTIVE DATA BY PEN - BOBWHITE QUAIL

## THIABENZADOLE 98.5% TECHNICAL

	Eggs Laid	Eggs Cracked	Eggs Set	Viable Embryos	Live Three - Week Embryos	Normal Hatchlings
Controls	49	6	40	27	27	18
	25	4	18	18	18	12
	61	13	45	29	29	21
	37	13	21	21	21	15
	64	20	40	38	38	30
	79	20	55	50	50	31
	52	9	40	38	37	32
	52	8	40	40	39	33
	74	9	61	60	60	43
	48	18	26	25	24	19
	47	12	31	29	29	23
	32	12	16	14	14	9
	Totals	619	144	433	389	386
80 ppm	36	11	21	21	20	14
	57	11	42	38	34	23
	66	22	40	30	24	13
	59	14	42	35	35	29
	80	12	64	7	7	6
	87	10	73	66	65	36
	75	14	57	24	24	15
	52	5	43	36	35	26
	54	10	41	35	31	23
	69	31	34	26	23	18
	42	23	15	14	14	9
70	24	42	37	37	26	
Totals	747	187	514	369	349	238

TABLE 3 (Continued)

REPRODUCTIVE DATA BY PEN - BOBWHITE QUAIL

THIABENZADOLE 98.5% TECHNICAL

	Eggs Laid	Eggs Cracked	Eggs Set	Viable Embryos	Live Three - Week Embryos	Normal Hatchlings
	40	12	24	20	20	17
	26	13	11	9	9	7
	47	14	29	23	21	14
	84	25	55	53	53	39
	64	10	50	47	47	31
400 ppm	51	4	43	32	32	21
	38	26	9	6	4	4
	66	10	52	52	51	40
	49	15	30	29	29	21
	83	40	40	40	40	31
	80	24	52	46	46	30
	44	10	30	26	24	20
Totals	672	203	425	383	376	275

D. Conclusions

1. Category: Core
2. Rationale: N/A
3. Respairability: N/A

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Thiabendazole  
Eggs laid Bobwhite Quail

ANOVA + DUNCAN

49.  
25.  
61.  
37.  
64.  
Control 79.  
52.  
52.  
74.  
48.  
47.  
31.

51.58333333 Mean  
240.0763889 Variance

36.  
57.  
66.  
59.  
80.  
80 ppm 87.  
75.  
52.  
54.  
69.  
42.  
70.

62.25 Mean  
210.0208333 Variance

40.  
26.  
47.  
84.  
64.  
400 ppm 51.  
38.  
66.  
49.  
83.  
80.  
44.

56. Mean  
336. Variance

1.205842859 F value  
2. numerator  
33. denominator

9433.166667 Error sum of sq.  
687.3888889 Trtmt " "  
10122.55556 Total " "

62.25 } Ranked  
56. } means  
51.58333333

3.04 SSR  
3. P

62.25  
51.58333333 ANOVA + DUNCAN NS

Thiabendazole  
Novmid Hatchlings

ANOVA + DUNCAN

Bob-  
white  
Quail

18.  
12.  
21.  
15.  
30.  
ANOVA + DUNCAN  
31.  
32.  
33.  
43.  
19.  
23.  
9.

Control

23.83333333 Mean  
92.63888889 Variance

14.  
23.  
13.  
29.  
80 ppm 6.  
36.  
15.  
26.  
23.  
18.  
9.  
26.

19.83333333 Mean  
71.47222222 Variance

17.  
7.  
14.  
39.  
31.  
400 ppm 21.  
4.  
40.  
21.  
31.  
30.  
20.

22.91666667 Mean  
122.7430556 Variance

.5051686152  
2.  
33.

3442.25  
105.3888888  
3547.638889

29.83333333  
22.91666667  
19.83333333

3.04  
3.

23.83333333  
19.83333333

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16 //SA335 EXEC SAS6, REGION=190K, PRINT=P  
 50 //INDATA DD DSN=CN.EPABTR.CESR.DAWN, DISP=SHR  
 110 //SYSIN DD \*  
 200 DATA;  
 250 INPUT CLASS 1 ELAID 4-5 ECRACK 8-9 ESET 12-13  
 300 VEMBRO 16-17 LEMBRO 20-21 NHATCH 24-25 SEX \$ 27-28;  
 400 IF CLASS=3 THEN DELETE;  
 700 PROC TTEST; CLASS SEX; TITLE THIABEND;  
 800 VARIABLES ELAID ECRACK ESET VEMBRO LEMBRO NHATCH;

Bobwhite Quail

THIABENDAZOL - 80 PPM 18:47 TUESDAY, SEPTEMBER 4, 1979

TTEST PROCEDURE

VARIABLE: ELAID

SEX	N	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM	VARIANCES	T	DF	PROB > T^
F	12	62.25000000	15.13650014	4.36953121	36.00000000	87.00000000	UNEQUAL	1.6675	21.9	0.1096
M	12	51.58333333	16.18337156	4.67173696	25.00000000	79.00000000	EQUAL	1.6675	22.0	0.1096

FOR H0: VARIANCES ARE EQUAL, F' = 1.14 WITH 11 AND 11 DF PROB > F' = 0.8284

VARIABLE: ECRACK

SEX	N	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM	VARIANCES	T	DF	PROB > T^
F	12	15.58333333	7.62124224	2.2006313	5.00000000	31.00000000	UNEQUAL	1.3436	19.5	0.1946
M	12	12.00000000	5.22232968	1.50755672	4.00000000	20.00000000	EQUAL	1.3436	22.0	0.1928

FOR H0: VARIANCES ARE EQUAL, F' = 2.13 WITH 11 AND 11 DF PROB > F' = 0.2256

VARIABLE: ESET

SEX	N	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM	VARIANCES	T	DF	PROB > T^
F	12	42.83333333	16.24154792	4.68853103	15.00000000	73.00000000	UNEQUAL	1.0852	21.6	0.2898
M	12	36.08333333	14.15792957	4.08704222	16.00000000	61.00000000	EQUAL	1.0852	22.0	0.2896

FOR H0: VARIANCES ARE EQUAL, F' = 1.32 WITH 11 AND 11 DF PROB > F' = 0.6567

VARIABLE: VEMBRO

SEX	N	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM	VARIANCES	T	DF	PROB > T^
F	12	30.75000000	14.79019946	4.26956282	7.00000000	66.00000000	UNEQUAL	-0.2893	21.8	0.7751
M	12	32.41666667	13.39917456	3.86800852	14.00000000	60.00000000	EQUAL	-0.2893	22.0	0.7751

FOR H0: VARIANCES ARE EQUAL, F' = 1.22 WITH 11 AND 11 DF PROB > F' = 0.7490

VARIABLE: LEMBRO

SEX	N	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM	VARIANCES	T	DF	PROB > T^
F	12	29.08333333	14.57556070	4.20760195	7.00000000	65.00000000	UNEQUAL	-0.5401	21.8	0.5946
M	12	32.16666667	13.36775859	3.85893951	14.00000000	60.00000000	EQUAL	-0.5401	22.0	0.5946

FOR H0: VARIANCES ARE EQUAL, F' = 1.19 WITH 11 AND 11 DF PROB > F' = 0.7793

VARIABLE: NHATCH

SEX	N	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM	VARIANCES	T	DF	PROB > T^
F	12	19.83333333	8.83004513	2.54901447	6.00000000	36.00000000	UNEQUAL	-1.0356	21.6	0.3118
M	12	23.83333333	10.05289043	2.90201950	9.00000000	43.00000000	EQUAL	-1.0356	22.0	0.3116

FOR H0: VARIANCES ARE EQUAL, F' = 1.30 WITH 11 AND 11 DF PROB > F' = 0.6745

TTEST computes t statistics for testing the hypothesis that the means of two groups of data are equal.  
 A t statistic is computed assuming the variances are equal in each group. An approximate t is also computed which assumes that the variances in the two groups are unequal. The degrees of freedom and probability level are given with each t statistic.  
 Approximation is used to compute the degrees of freedom associated with the approximation. An F (folded) statistic is computed to test for equality of the two variances.

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>lis  
 10 //SAS\$6 EXEC SAS6, REGION=190K, PRINT=P  
 50 //INDATA DD DSN=CN.EFABTR.CESR.DAWN, DISP=SHR  
 110 //SYSIN DD \*  
 200 DATA;  
 250 INFILE INDATA;  
 300 INPUT CLASS 1 ELAID 4-5 ECRACK 8-9 ESET 12-13  
 310 VEMBR0 15-17 LEMBRO 20-21 NHATCH 24-25 SEX \$ 27-28;  
 400 IF CLASS=2 THEN DELETE;  
 700 PROC TTEST; CLASS SEX; TITLE THIABEND;  
 800 VARIABLES ELAID ECRACK ESET VEMBR0 LEMBRO NHATCH;

Bobwhite Quail

THIABENDAZOLE - 400 PPM 18:48 TUESDAY, SEPTEMBER 4, 1979

TTEST PROCEDURE

t-test for means

TTEST computes t statistics for testing the hypothesis that the means of two groups of data are equal.

A t statistic is computed assuming the variances are equal in each group. An approximate t is also computed which assumes that the variances in the two groups are unequal. The degrees of freedom and probability level are given with each t. Satterthwaite's approximation is used to compute the degrees of freedom associated with the t approximation. An F (folded) statistic is computed to test for equality of the two variances.

VARIABLE: ELAID

SEX	N	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM	VARIANCES	T	DF	PROB > T*
F 400 ppm	12	56.00000000	19.14537685	5.52679424	26.00000000	84.00000000	UNEQUAL	0.6103	21.4	0.5481
M 400 ppm	12	51.58333333	16.18337156	4.67173696	25.00000000	79.00000000	EQUAL	0.6103	22.0	0.5479

FOR HO: VARIANCES ARE EQUAL, F' = 1.40 WITH 11 AND 11 DF    PROB > F' = 0.5867

VARIABLE: ECRACK

SEX	N	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM	VARIANCES	T	DF	PROB > T*
F 400 ppm	12	16.91666667	9.96775103	2.87744187	4.00000000	40.00000000	UNEQUAL	1.5135	16.6	0.1489
M 400 ppm	12	12.00000000	5.22232968	1.50755672	4.00000000	20.00000000	EQUAL	1.5135	22.0	0.1444

FOR HO: VARIANCES ARE EQUAL, F' = 3.64 WITH 11 AND 11 DF    PROB > F' = 0.0423

VARIABLE: ESET

SEX	N	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM	VARIANCES	T	DF	PROB > T*
F 400 ppm	12	35.41666667	15.80827363	4.56345552	9.00000000	55.00000000	UNEQUAL	-0.1088	21.7	0.9143
M 400 ppm	12	36.08333333	14.15792957	4.08704222	16.00000000	61.00000000	EQUAL	-0.1088	22.0	0.9143

FOR HO: VARIANCES ARE EQUAL, F' = 1.25 WITH 11 AND 11 DF    PROB > F' = 0.7210

VARIABLE: VEMBR0

SEX	N	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM	VARIANCES	T	DF	PROB > T*
F 400 ppm	12	31.91666667	15.95709209	4.60541571	6.00000000	53.00000000	UNEQUAL	-0.0831	21.4	0.9345
M 400 ppm	12	32.41666667	13.39917456	3.86800852	14.00000000	60.00000000	EQUAL	-0.0831	22.0	0.9345

FOR HO: VARIANCES ARE EQUAL, F' = 1.42 WITH 11 AND 11 DF    PROB > F' = 0.5720

VARIABLE: LEMBRO

SEX	N	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM	VARIANCES	T	DF	PROB > T*
F 400 ppm	12	31.33333333	16.32807584	4.71350949	4.00000000	53.00000000	UNEQUAL	-0.1368	21.2	0.8925
M 400 ppm	12	32.16666667	13.36775859	3.85893951	14.00000000	60.00000000	EQUAL	-0.1368	22.0	0.8924

FOR HO: VARIANCES ARE EQUAL, F' = 1.49 WITH 11 AND 11 DF    PROB > F' = 0.5180

VARIABLE: NHATCH

SEX	N	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM	VARIANCES	T	DF	PROB > T*
F 400 ppm	12	22.91666667	11.57158222	3.34042806	4.00000000	40.00000000	UNEQUAL	-0.2072	21.6	0.8378
M 400 ppm	12	23.83333333	10.05289043	2.90201950	9.00000000	43.00000000	EQUAL	-0.2072	22.0	0.8378

FOR HO: VARIANCES ARE EQUAL, F' = 1.32 WITH 11 AND 11 DF    PROB > F' = 0.6488

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