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COTTONTAIL REPRODUCTION RELATED TO DIELDRIN EXPOSURE

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ABSTRACT

Wild-trapped young-of-the-year cottontails (Sylvilagus floridanus), confined in 1-acre pens, were exposed to annual ground applications of 0.5 and 2.0 pounds/acre of granular dieldrin. Reproductive data from rabbits in treated pens were compared with control groups during six breeding seasons, 1966-1971.

Breeding male rabbits in the pens showed no sign of reproductive abnormality. Testis weights were comparable at all dosage levels ($P > 0.05$) and spermatozoa were evident in microscopic examinations of the seminiferous tubules.

No measurable differences in onset and synchrony of breeding were found among females in treated and control groups. Conception dates for the penned rabbits corresponded closely with those of wild, unpenned cottontails collected nearby.

Based on second pregnancies, ovulation rates, preimplantation losses, resorption of embryos, and embryonic litter size were not significantly affected ($P > 0.05$) by the treatments.

Residue levels in brain, liver, and muscle tissues of rabbits from the two treatment levels were significantly higher than those of control animals. A comparison of brain residue levels within the two treatment groups also indicated that accumulation of the pesticides was related to the amount applied. Lethal accumulations of dieldrin were found in brains of three cottontails. We recovered fewest breeding animals from pens with highest treatment levels, but differences in recovery rates were not significant ($P > 0.05$). No adequate measures of postnatal mortality were obtained.

Paired adrenal weight:body weight and spleen weight:body weight ratios, plus histological information about cortical lipid distribution in the adrenal glands showed no conclusive evidence of stress among penned animals, whether treated or not.

Dieldrin persisted in soil from 1 year to the next, following the annual applications, which fell within the limits of recommended agricultural rates. Dieldrin residue levels in cottontail tissues (brain, liver, muscle) reflected application rates and soil residue levels.

INTRODUCTION

Mechanisms by which organochlorine insecticides affect organisms are not completely understood. Toxic responses of wild animals, involving the peripheral and central nervous systems, are often observed following administration of lethal doses or heavy field applications. Subtle effects of non-lethal doses are far less distinguishable, but may be very important. Alterations of hormone and enzyme metabolism are possible consequences (Peakall, 1967; Hart et al., 1971). The influence of such changes on population dynamics of the species involved is not clear. Information about the effects of organochlorines on the reproductive performance of wild animals exposed to these insecticides is needed.

The purpose of this investigation was to test the effects of dieldrin (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro 1:4,5:8-dimethanonapthalene) on the reproductive processes of the cottontail (Sylvilagus floridanus). The cottontail was selected due to: (1) its prevalence on farmland where pest control practices make it a readily exposed nontarget species, and (2) the abundance of reproductive data on this species under both wild and semiwild conditions, facilitating evaluation of treatment effects.

MATERIALS AND METHODS

Twelve 1-acre pens were constructed at the University of Missouri's Ashland Wildlife Area in Boone County, Missouri. Pen walls made of 1-inch mesh poultry wire were 5 feet high with an additional 6 inches of wire buried in the ground. An electric wire was installed around the top of the fence and padded steel traps were placed on posts in and around the pens to minimize losses to predators. Cedar brush piles were provided to supplement natural cover.

Commercial rabbit pellets were offered ad libitum in covered feeders. Food plots 20 x 150 feet were planted to milo in each enclosure.

Soil samples were obtained annually from all pens beginning in November 1965 (before initial application of dieldrin) and ending in April 1971. Twenty-five samples (minimum of 25 grams each) were randomly collected from approximately the top 3 inches of soil in each pen during 1965-69. These were then combined to give one aggregate sample for each pen.

Prior to 1965, none of the 12 pens had been treated with pesticides, and all were relatively free of them. Four pens served as controls and received no treatment. From 1965 to 1971, annual treatments of 5% granular dieldrin were applied to the remaining pens during December and January, after the pens were stocked with cottontails. Four received 0.5 pound/acre of active dieldrin and the other four, 2.0 pounds/acre. Applications were made by a tractor-mounted broadcast seeder. Application levels were within ranges recommended (before inception of the experiments) for white-fringed beetle control in cottonfields or for control of several species of insects in ungrazed turf areas (United States Department of Agriculture, 1965). Our application levels were well below the 3.0 pounds/acre used by Federal and State agencies in an intensive campaign against Japanese beetles near Sheldon, Illinois, in 1954-55 (see Scott et al., 1959).

Test animals were live trapped within a 20-mile radius of the research site. Ear-tagged cottontails were stocked annually in a ratio of 1 male:2 females (except 1971) in each of the 12 pens. In 1966 through 1968, each pen received 2 males and 4 females; in 1969, 4 males and 8 females; and in 1971, 5 males and 12 females. Only young-of-the-year were used to assure some uniformity in reproductive performance (Conaway et al., 1963). Animals trapped in the wild prior to December, and weighing less than 900 grams, were considered to be juveniles of that year. This criterion has been substantiated under comparable conditions by lens weight comparisons (Sadler, unpublished data).

Rabbits were left in the treated and control pens until the females were approximately 18 days pregnant with the second litter. At this time all penned rabbits were collected, sacrificed, and weighed. Reproductive organs, spleens, and adrenals were removed and fixed in either 10% formalin or a solution of alcohol, formalin, and acetic acid (AFA). Samples of brain, liver, and muscle were immediately frozen for dieldrin analysis.

In 1970, rabbits introduced into the pens the previous fall were allowed to breed for a full season, then removed from the pens. Young-of-the-year progeny of these rabbits were then kept in the pens until the following spring breeding season. The purpose of this procedure was to evaluate the effects of dieldrin on first season reproduction of rabbits born to exposed parents in the pens.

In the spring of 1968, heavy predation occurred in the pens and no meaningful reproductive data are available for that year. However, data on dieldrin residues and spleen and adrenal condition from that year are included in this presentation.

Chemical analyses were made by WARF Institute, Inc.,[1/] using electron capture gas chromatography. Methodology is described in Appendix I.

Captive females were trapped each spring to determine breeding condition, using Haugen's (1942) procedure involving palpation of the abdominal walls between the thumb, index, and middle fingers to locate uterine swellings at the sites of embryo implantation. These swellings were classified by approximate size: peanut (age of embryo=10 days); acorn (age=15 days); or walnut (age=20 days). The time of the year and the fact that abdominal hair had not been pulled to line a previous nest served as indicators that the female was pregnant with her first litter of the year. Wild, free-ranging cottontails were periodically collected in the vicinity of the pens, palpated, then autopsied to corroborate breeding condition assessments made by abdominal palpation of penned rabbits.

We assumed that penned and wild rabbits were in similar stages of pregnancy, as was true in other central Missouri studies (Conaway and Wight, 1962). The limited collections outside our pens reinforced this assumption.

[1/] Companies referred to in this publication do not imply endorsement of the service by the Government.

When females were approximately 18 days pregnant with their second litter, corpora lutea resulting from the second pregnancy were easily visible and the first-litter young had been weaned. Also, the critical stage of resorption was past, permitting a more accurate determination of litter size (Brambell and Mills, 1948).

Ovaries from all females were sectioned at 10 microns and mounted as interrupted serials (every tenth section mounted). Sections were stained with a modified Schorr stain and examined microscopically. Particular attention was given to the following: 1) primary follicles in the ovarian cortex and sinusoids in the corpora lutea (di Fiore, 1961); 2) necrosis and degeneration of germinal epithelium (Albert, 1962); 3) cell size and nucleus size; and 4) character of the ovarian connective tissue. The ovulation rate was then determined by counting the number of corpora lutea in the sectioned ovaries.

A wedge was removed from each testis, and slides were prepared using the same staining and mounting procedures as described for the ovaries. Sections were examined for the following indications of pathological conditions: 1) degeneration and disappearance of spermatogenic cells; 2) dividing Sertoli cells; 3) giant multi-nucleated developing sperm cells; and 4) abnormally large numbers of fibroblasts in interstitial areas (Maximow and Bloom, 1957).

During autopsies, embryo age was obtained by visually estimating the size of the uterine swellings. From this information, the time of second litter conception was determined. Females having no visible embryos, but showing other signs of an earlier pregnancy (i.e. having little or no fat, possessing well-developed mammary glands which exuded milk when sliced, or having abdominal hair pulled) were considered as being in preimplantation postpartum pregnancy. This judgment was based on the findings of Wight and Conaway (1962) who noted that almost all female cottontails breed postpartum after first pregnancies. Approximate dates for the onset of breeding were established by backdating 28 days (average gestation) from second litter conception dates.

RESULTS

Onset and Synchrony of Breeding

In each year, the majority of females from the control pens and those of both treatment levels could be divided into two main groups with respect to time of onset of breeding. For the entire study, dates of onset of breeding were as follows: March 1 and March 8-9, 1966; March 2 and March 10, 1967; March 16 and March 23,

1969; March 1 and March 12, 1971. In each instance breeding periodicity was substantiated by comparable data from wild cottontails in the region.

Although cottontails are generally synchronous breeders, a few individuals conceived between the breeding dates established for most years, as shown by ages of embryos collected on a single day (Appendix II, Table A). Such findings are not unusual, however, since unfavorable weather occurring at this time of the year has been shown to upset this synchrony (Marsden and Conaway, 1963; Sadler and Conaway, 1971).

Ovulation

Each year, the ovulation rate of female cottontails was numerically higher for rabbits at the 2.0 pounds/acre treatment level than for those at the other levels (Table 1). These differences, however, were not significant (analysis of variance; $0.5 < P < 0.10$). There were no statistically significant differences in ovulation rates by year within the same treatment levels.

Table 1. Mean ovulation rates per female cottontail for second litters.

	No treatment (control)	Dieldrin treatment level	
		0.5 lb/acre	2.0 lbs/acre
Year	$\bar{x}$ Sx	$\bar{x}$ $S_{\bar{x}}$	$\bar{x}$ $S_{\bar{x}}$
1966	5.64 ± 0.372	5.86 ± 0.466	6.80 ± 0.551
1967	6.50 ± 0.872	6.13 ± 0.436	7.00 ± 0.712
1969	6.67 ± 0.318	7.21 ± 0.330	7.94 ± 0.308
1971	5.83 ± 0.229	5.68 ± 0.221	5.90 ± 0.283

It is possible that the number of ova recorded is biased upwards. This could occur if luteinized follicles existed which could not be differentiated from true corpora lutea (Conaway and Wight, 1962).

A few instances of polyovulation were observed in both control and treated females. For example, rabbit no. 1545 (control, 1966) had seven embryos (six viable, one resorbing), but only six corpora lutea (see Appendix II, Table A). Polyovulation was not a significant source of error in determination of ovulation rates because it was infrequent; this conclusion was also reached by Wight and Conaway (1962).

In 1967, two of five females from the 2.0 pounds/acre dieldrin treatment showed no corpora lutea or albicantia in the ovaries for either the first or second litters of the year. This is unusual for cottontails once most females are pregnant with

their second litters, as shown by Conaway and Wight (1962). However, no comparable observations were made in 1966 or any of the years after 1967.

Histological examination of the ovaries from control rabbits and dieldrin-treated rabbits failed to reveal any abnormalities or even any notable differences according to treatment.

Prenatal Mortality

Preimplantation Losses.--A comparison of the number of corpora lutea with the total number of embryos present (alive or resorbing) late in gestation provides an index to the proportion of released ova that failed to implant in the uteri. Appropriate data are summarized in Table 2 and presented for individual females in Appendix II, Table A.

In females from the control pens, preimplantation losses of ova ranged from 0-8.1%. These figures are consistent with findings of Conaway and Wight (1962), who stated that in most cottontail populations, approximately 2-8% of the ovulated ova are lost before implantation.

Table 2. Preimplantation losses for the second litter of the year in treated females and controls.

	Dieldrin treatment level		
	No treatment (control)	0.5 lb/acre	2.0 lbs/acre
1966			
Total number of corpora lutea observed	62	41	34
Number of released ova not implanting in uteri	1	0	6
Preimplantation loss (percentage)	1.6	0.0	17.6
1967			
Total number of corpora lutea observed	13	49	21
Number of released ova not implanting in uteri	0	3	2
Preimplantation loss (percentage)	0.0	6.1	9.5
1969			
Total number of corpora lutea observed	37	49	111
Number of released ova not implanting in uteri	3	10	19
Preimplantation loss (percentage)	8.1	20.4	17.1
1971			
Total number of corpora lutea observed	146	165	112
Number of released ova not implanting in uteri	9	27	6
Preimplantation loss (percentage)	6.1	16.3	5.3

Table 3. Partial litter resorption in cottontails treated with dieldrin and in controls.

Year	Controls (no treatment)			Dieldrin treatment level					
				0.5 lbs/acre			2.0 lbs/acre		
	Total embryos (no.)	Embryos resorbing (no.)	Percent	Total embryos (no.)	Embryos resorbing (no.)	Percent	Total embryos (no.)	Embryos resorbing (no.)	Percent
1966	56	4	7.1	42	3	7.1	28	1	3.6
1967	13	1	7.6	36	5	13.9	19	0	0.0
1969	34	0	0.0	39	3	7.6	92	0	0.0
1971	137	4	2.9	144	7	4.9	106	2	1.9

Year	Total females (no.)	Females with resorbing embryos	Percent	Total females (no.)	Females with resorbing embryos	Percent	Total females (no.)	Females with resorbing embryos	Percent
1966	10	3	30.0	7	2	28.5	5	1	20.0
1967	2	1	50.0	6	2	33.3	3	0	0.0
1969	6	0	0.0	7	1	14.2	14	0	0.0
1971	25	2	8.0	28	6	21.4	19	1	5.3

In our dieldrin-treated pens (both levels) preimplantation losses of ova were generally higher than in control pens, and ranged upward to 20.4% (Table 2). However, there was great variability, and differences between controls and treated pens were not significant ($P > 0.05$; chi-square test).

Litter Resorption.--Data from females with partially resorbed litters are shown in Appendix II, Table A. Table 3 presents a summary of those data.

For partially resorbed litters, a chi-square test showed no significant differences ($P > 0.05$) in embryo resorption between rabbits in either of the two dieldrin treatments and the controls. Similarly, the number of females with partially resorbed litters was not related to the treatment level.

In 1966, two instances of total litter resorption were noted; both occurred in control females. One female resorbed a litter of five and the other a litter of undetermined size.

Three additional cases of total litter resorption were observed in subsequent years. All involved females were from the pens treated with 0.5 pound/acre of dieldrin; litter sizes were four and six (1967) and four (1971).

Embryonic Litter Size

Complete data on numbers of embryos per female are shown in Appendix II, Table A and summarized in Table 4.

Table 4. Mean embryonic litter sizes for female cottontails in control and treated pens, 1966-71 (viable embryos only).

Year	No treatment (control) $\bar{x}$	$S_{\bar{x}}$	Dieldrin treatment level: 0.5 lb/acre $\bar{x}$	$S_{\bar{x}}$	2.0 lbs/acre $\bar{x}$	$S_{\bar{x}}$
1966	5.20	± 0.425	5.57	± 0.508	5.40	± 0.601
1967	6.00	± 0.950	5.17	± 0.548	6.33	± 0.776
1969	5.67	± 0.548	5.14	± 0.508	6.57	± 0.359
1971	5.32	± 0.269	4.89	± 0.254	5.47	± 0.308

Analysis of variance showed that litter size was not significantly different ($P > 0.05$) between controls and treated groups or among years within treatments.

Testes

Testes were removed, fixed in AFA solution and stored for 2 months. After epididymis and connective tissue were removed, one testis (fixed) from each animal was weighed. Testis weights are presented in Appendix II, Table A, and are summarized in Table 5.

Table 5. Mean testis weights in grams for breeding males (1966-71).

Year	No treatment (control) $\bar{x}$	$S_{\bar{x}}$	Dieldrin treatment level 0.5 lb/acre $\bar{x}$	$S_{\bar{x}}$	2.0 lbs/acre $\bar{x}$	$S_{\bar{x}}$
1966	9.44	± 0.691	8.63	± 0.691	9.06	± 0.640
1967	10.69	± 1.197	8.25	± 0.000	8.91	± 0.977
1969	9.34	± 0.452	9.59	± 0.535	9.63	± 0.691
1971	9.42	± 0.535	10.20	± 0.510	9.79	± 0.510

Analysis of variance comparing testis weights between treatment levels and between years revealed no significant differences ($P > 0.05$).

No signs of testis degeneration were evident through histological examination, and spermatozoa were found in the seminiferous tubules of all males.

Lactation

We assumed that increased proportions of nonlactating females in treated pens would reflect increased juvenile mortality related to dieldrin treatment levels, or possibly some delay in conceptions. Detailed lactation data are presented in Appendix II, Table A, and summarized in Table 6.

Table 6. Recovery rates and lactation data for females collected between 1966 and 1971.

	No treatment (control)	Dieldrin treatment level 0.5 lb/acre	2.0 lbs/acre
1966			
Number of females: Recovered	12	7	5
Lactating	6	4	2
Percentage lactating	50.0	57.1	40.0
1967			
Number of females: Recovered	2	8	4
Lactating	2	7	3
Percentage lactating	100.0	87.5	75.0
1969			
Number of females: Recovered	16	14	16
Lactating	13	10	14
Percentage lactating	81.3	71.4	87.5
1971			
Number of females: Recovered	29	30	19
Lactating	19	21	11
Percentage lactating	65.5	70.0	57.9

No significant differences were found between the percentage of lactating females in the control pens and those of the two treatment levels (chi-square test: $P > 0.05$).

Inspection of lactation data and all reproductive parameters previously considered shows no consistent differences in reproductive performance between wild-trapped rabbits stocked annually in the pens, 1966-69, and the rabbits breeding in 1971, born of captive parents (Tables 1-6).

Adult Mortality

Mortality estimates of breeding adults in the treated pens and control pens were obtained for 1966, 1969, and 1971 by a comparison of the numbers originally stocked with those recovered at the time of collection (Table 7). Because of heavy losses to predation, similar data were not available for 1967 and 1968; in 1970, cottontails were left in the pens as breeders.

Table 7. Adult cottontails recovered in spring from pens stocked the previous fall.

		No treatment (control)		Dieldrin treatment level: 0.5 lb/acre		Dieldrin treatment level: 2.0 lbs/acre	
1966		F	M	F	M	F	M
Number of rabbits:	Stocked	16	8	16	8	16	8
	Recovered	12	6	8	6	5	7
Percentage recovered		75.0		58.3		50.0	
1969							
Number of rabbits:	Stocked	32	16	32	16	32	16
	Recovered	19	14	20	10	17	6
Percentage recovered		68.8		62.5		47.9	
1971							
Number of rabbits:	Stocked	48	20	48	20	48	20
	Recovered	29	10	31	11	19	11
Percentage recovered		57.4		61.8		44.1	

Although fewer rabbits were recovered from the treated pens than from controls, the difference was not statistically significant (chi-square test, $P > 0.05$).

No systematic attempt was made to determine the fate of individual rabbits in the pens prior to collection. However, in the dieldrin-treated pens, some mortality was observed which appeared to be related to the pesticide. Rabbits found dead in these pens often showed no external injuries, were very emaciated, and in some instances, contained frothy intestinal contents. Rabbit mortality was most noticeable soon after application of dieldrin to the soil.

Raptorial birds preyed on some rabbits in most pens, but we could not determine whether raptors preferentially fed on rabbits in pens treated with dieldrin.

Chemical Residue Determinations

Dieldrin in Cottontail Tissues.--Residue data for 1966 through 1971 are presented in Appendix II, Table B, and summarized in Table 8. In 1966 and 1968, residue determinations were made separately on tissue samples from individual animals. In the other years, tissue samples from various numbers of individuals were pooled; numbers of samples comprising the pools are shown in Table 8.

In 1966, three separate sets of dieldrin residue analyses were made. One set consisted of analyses of tissue samples from individual adult rabbits; this set is alluded to above, and tallied in Appendix II, Table B. A second set was made on pooled tissues collected from different combinations of adult animals recovered at each of the three treatment levels as a guide for subsequent pooling procedure. The third set consisted of analyses performed on pooled tissues from the progeny (first litter of the year) of these adults. The latter two sets were not considered in the statistical analyses of the data, but are placed on record in Appendix II, Tables C and D.

Large variances in the data and small sample size necessitated using the Mann-Whitney U test for statistical testing. This nonparametric test provides the same function as the "t" test, but does not require such restrictive assumptions. Comparisons of dieldrin tissue residue data are made by combining the sample results from any two groups and ranking these while still maintaining their individual identity. Differences in the sums of these ranks are then responsible for the different significance levels.

In testing the null hypothesis that observations from two populations are identical, differences between controls and treated groups are expressed at the following significance levels:

** - implies a significant difference at the 10% level

* - implies significance at the 25% level and is used whenever the sample size is so small that 10% significance cannot be achieved by use of the tables (from Siegel, 1956).

In 1967, too few males were collected for the data to be analyzed statistically (see column n, Table 8).

Table 8. Dieldrin determinations (ppm wet weight) for adult cottontails in experimental and control pens (1966-71).

Sample	No treatment (control) $\bar{x}$	$S\bar{x}$	n†	Dieldrin treatment level: 0.5 lb/acre $\bar{x}$	$S\bar{x}$	n†	2.0 lbs/acre $\bar{x}$	$S\bar{x}$	n†
1966+									
				Females					
Brain	0.036	± 0.028	2	0.219	± 0.093	4	**0.420	± 0.078	4
Liver	0.083	± 0.007	2	**4.125	± 1.138	4	**7.825	± 1.616	4
Muscle	0.01	-	2	**0.054	± 0.018	3	**0.088	± 0.023	4
				Males					
Brain	0.01	-	2	*0.183	± 0.034	4	*0.390	± 0.104	3
Liver	0.061	± 0.002	2	*5.300	± 1.520	4	*6.350	± 1.333	4
Muscle	0.01	-	2	*0.036	± 0.003	3	*0.149	± 0.084	4
1967+									
				Females					
Brain	0.01	-	3(1)	*0.049	± 0.008	9(5)	*0.186	± 0.044	5(3)
Liver	0.049	± 0.0	3(1)	*0.997	± 0.142	6(3)	*5.017	± 1.749	5(3)
Muscle	0.01	-	3(1)	0.013	± 0.004	8(4)	0.052	± 0.030	4(2)
				Males					
Brain	0.01	-	3(1)	0.069	± 0.0	1(1)	0.113	± 0.042	3(2)
Liver	0.11	± 0.0	2(1)	No data	-	0	3.500	± 0.639	3(2)
Muscle	0.01	-	3(1)	0.01	-	1(1)	0.022	± 0.003	3(2)
1968+									
				Females					
Brain	0.01	-	5	**0.262	± 0.101	5	**0.661	± 0.251	7
Liver	0.052	± 0.013	5	**3.026	± 0.841	5	**4.330	± 1.455	7
Muscle	0.011	± 0.002	5	**0.043	± 0.015	5	**0.149	± 0.094	7
				Males					
Brain	0.01	-	4	**0.110	± 0.0	2	*0.36	± 0.0	1
Liver	0.071	± 0.011	4	**2.725	± 0.885	2	*6.69	± 0.0	1
Muscle	0.01	-	4	**0.112	± 0.019	2	*0.062	± 0.0	1
1969++									
				Females					
Brain	0.005	-	19(8)	**0.094	± 0.012	20(9)	**0.339	± 0.042	17(7)
Liver	0.348	± 0.135	19(8)	**2.619	± 0.433	20(9)	**5.903	± 0.634	17(7)
Muscle	0.005	-	19(8)	**0.027	± 0.004	20(9)	**0.050	± 0.009	17(7)
				Males					
Brain	0.006	± 0.002	14(6)	*0.148	± 0.024	10(5)	*0.523	± 0.112	6(3)
Liver	0.180	± 0.035	14(6)	*5.100	± 0.634	10(5)	*7.750	± 2.653	6(3)
Muscle	0.005	-	14(6)	*0.028	± 0.006	10(5)	*0.187	± 0.047	6(3)
1971++									
				Females					
Brain	0.005	-	30(7)	**0.104	± 0.010	31(7)	**0.328	± 0.057	19(5)
Liver	0.033	± 0.003	30(7)	**1.474	± 0.153	31(7)	**3.448	± 0.564	19(5)
Muscle	0.005	-	30(7)	**0.020	± 0.003	30(7)	**0.064	± 0.012	19(5)
				Males					
Brain	0.005	-	9(3)	**0.120	± 0.018	11(3)	**0.375	± 0.068	11(2)
Liver	0.067	± 0.013	9(3)	**3.307	± 0.565	11(3)	**6.185	± 1.172	11(2)
Muscle	0.005	-	9(3)	*0.045	± 0.008	11(3)	0.057	± 0.012	11(2)

\+ Sensitivity = 0.01 ppm ($S\bar{x}$ values involving trace amounts based on
++ Sensitivity = 0.005 ppm one-half the sensitivity values)
** Significantly different from controls ($P<0.10$; Mann-Whitney U test)
* Significantly different from controls ($P<0.25$; Mann-Whitney U test)
† Individuals; number of pooled samples in parentheses.

Residue levels in brain, liver, and muscle tissues of rabbits from the two dieldrin-treatments were significantly higher than those of control animals (see Table 8). A comparison of brain residue levels by treatment groups also indicated that accumulation of the pesticide was related to the amount applied in the pens.

Stickel et al. (1969:197) have shown that the brain is a useful tissue in appraising the probability of death from dieldrin poisoning. They cautioned that "...1 p.p.m. in the brain cannot be regarded lightly, for when brain residues are that high, body residues are many times as great." Some dieldrin levels in rabbit brains reported for this study thus strongly suggest a potential lethal condition for these animals. Three rabbits found dead in the pens during 1966 had brain residue levels of 26, 31, and 31 ppm of dieldrin.

Dieldrin in the Soil.--Chemical analyses showed general agreement between annual application rates of dieldrin and residue levels in soils, with a minor exception in the samples collected in November 1969 (Table 9 and Appendix II, Table E).

Dieldrin persisted in the soil from one annual treatment to the next. After 1966, residue levels in soils of treated pens exceeded amounts applied annually, based on computations described by Korschgen (1970:189-190). Residue levels in soil before the fifth treatment provided additional evidence of persistence (Table 9).

Variability in the data over the 6-year period precluded firm conclusions about rates of accumulation of dieldrin in the soil. This variability may be attributable to: 1) precipitation causing the mechanical movement of dieldrin into low areas; 2) nonuniform application of the pesticide because of vegetation; 3) time of year samples were collected; and 4) inconsistency in the soil collection technique (the 1970 and 1971 collections were taken at somewhat shallower depths than the intended 3 inches).

Dieldrin in Plants.--Three plant species in the pens were collected in June 1970 and analyzed for dieldrin (Table 10) by the Bureau of Sport Fisheries and Wildlife Fish-Pesticide Research Laboratory, Columbia, Missouri (see Appendix I for methodology). Plants analyzed were among the preferred natural food sources in the pens (orchard grass, Dactylis glomerata; broomsedge, Andropogon virginicus; and panic grass, Panicum sp.).

In the treated pens, all plant samples tested had measurable amounts of dieldrin. Thus, plant food was one of the sources of dieldrin accumulation in the rabbits.

Table 9. Dieldrin residues in soil in experimental and control pens.

Rate of dieldrin application	ppm dieldrin recovered (wet wt.)†	$S\bar{x}$	Range
November 1965+ (before treatment)			
Control	0.01	-	-
0.5 lb/acre	0.01	-	-
2.0 lbs/acre	0.01	-	-
May 1966+ (after first treatment)			
Control	0.01	-	-
0.5 lb/acre	0.383	0.112	0.15 - 0.56
2.0 lbs/acre	*0.765	0.211	0.25 - 1.22
1967 - No analysis made between second and third treatments.			
May 1968++ (after third treatment)			
Control	0.015	0.003	- - .02
0.5 lb/acre	*3.050	0.668	2.22 - 4.62
2.0 lbs/acre	*6.268	1.640	4.50 - 10.10
June 1969++ (after fourth treatment)			
Control	0.005	-	-
0.5 lb/acre	*2.720	0.878	0.72 - 5.00
2.0 lbs/acre	*3.750	1.171	2.19 - 7.19
November 1969++ (before fifth treatment)			
Control	0.296	0.282	- - 1.14
0.5 lb/acre	*2.913	2.247	0.12 - 9.61
2.0 lbs/acre	*2.408	0.410	1.72 - 3.53
July 1970++ (after fifth treatment)			
Control	0.005	0.001	- - 0.007
0.5 lb/acre	*2.593	0.459	1.78 - 3.91
2.0 lbs/acre	*8.230	1.471	5.31 - 10.0
April 1971++ (after sixth treatment)			
Control	0.005	-	-
0.5 lb/acre	*2.915	0.448	1.89 - 3.91
2.0 lbs/acre	*10.333	2.845	5.39 - 17.7

\+ Sensitivity = 0.01 ppm.
++ Sensitivity = 0.005 ppm.
† 1968 samples were dried before analyses, resulting in disproportionately high residue values.
* Significantly different from controls ($P < 0.10$) - "t" test. ($S\bar{x}$ values involving trace amounts based on one-half the sensitivity values.)

Table 10. Dieldrin content of some selected plant species (ppm).

June 1970	No treatment (controls)	0.5 lb/acre	2.0 lbs/acre
Orchard grass (Dactylis) (blades)	0.0	0.127	0.250
Orchard grass (Dactylis) (seed heads)	0.004	0.028	0.075
Broomsedge (Andropogon) (seed heads)	0.0	0.024	0.139
Panic grass (Panicum) (blades and stalks)	0.009	0.012	0.093

Stress

Adrenal glands were fixed in 10% formalin at the time of removal from the rabbits. Gland capsules were then stripped of extraneous connective tissue and weighed.

One adrenal from each rabbit was sectioned at 20 microns with a freezing microtome, collected in water, and stained with oil-red-O lipid specific stain according to the method described by Fickess (1963). Following microscopic examination of the sections, adrenals were classified according to content and distribution of cortical lipid material as described by Fickess (1963). This classification system has six types of lipid distribution in adrenals, which can be related to stress. In our study, no differences in lipid distribution were noted in adrenals from control rabbits compared with those of the dieldrin-treated pens.

Mean paired adrenal weight (mg):body weight (g) ratios and mean spleen weight (mg):body weight (g) ratios were also used to determine if any major physiologic responses were apparent as a result of the dieldrin treatments. We assume that if the pesticide had acted as a constant source of stress, some deviation in these ratios would be observed. This response would be in accord with the rationale of Selye's General Adaptation Syndrome (Selye, 1946), in which thymo-lymphatic atrophy and adrenal cortical hypertrophy are recognized as two of the first responses observed in animals under stress.

Both adrenal and spleen weight:body weight ratios differed by sex, year, and treatment, but differences showed no consistent patterns (Tables 11 and 12). Thus, these ratios provide no indication of differential physiological stress as a result of treatment.

Table 11. Mean adrenal weight (mg):body weight (g) ratios of adult cottontails treated with dieldrin and of controls (1966-71).

	No treatment (control)			Dieldrin treatment level					
				0.5 lb/acre			2.0 lbs/acre		
	$\bar{x}$	$S\bar{x}$	n	$\bar{x}$	$S\bar{x}$	n	$\bar{x}$	$S\bar{x}$	n
1966									
Females	0.20	0.015	12	0.18	0.021	6	0.16	0.023	5
Males	0.18	0.025	4	0.20	0.021	6	0.22	0.019	7
1967									
Females	0.13	0.029	3	0.14	0.018	8	0.15	0.021	6
Males	0.20	0.029	3	0.17	-	1	0.16	0.029	3
1968									
Females	0.35	0.025	4	0.22	0.025	4	0.24	0.234	5
Males	0.37	0.025	4	0.30	0.036	2	0.37	-	1
1969									
Females	0.15	0.013	15	0.15	0.012	17	0.16	0.013	16
Males	0.21	0.015	12	0.18	0.016	10	0.20	0.021	6
1971									
Females	0.11	0.012	18	0.12	0.012	19	0.13	0.019	7
Males	0.18	0.016	10	0.16	0.019	7	0.17	0.036	2

Table 12. Mean spleen weight (mg):body weight (g) ratios of adult cottontails treated with dieldrin and of controls (1966-71).

	No treatment (control)			Dieldrin treatment level					
				0.5 lb/acre			2.0 lbs/acre		
	$\bar{x}$	$S\bar{x}$	n	$\bar{x}$	$S\bar{x}$	n	$\bar{x}$	$S\bar{x}$	n
1966									
Females	0.29	0.160	12	0.28	0.209	7	0.32	0.248	5
Males	0.54	0.277	4	0.41	0.209	7	0.26	0.209	7
1967									
Females	0.83	0.320	3	0.47	0.196	8	0.90	0.248	5
Males	1.46	0.320	3	1.28	-	1	0.75	0.320	3
1968									
Females	1.11	0.277	4	0.70	0.320	3	0.79	0.248	5
Males	1.23	0.277	4	1.29	0.392	2	1.21	-	1
1969									
Females	1.09	0.134	17	1.15	0.124	20	1.18	0.134	17
Males	1.38	0.154	13	1.02	0.175	10	0.56	0.226	6
1971									
Females	0.55	0.109	26	0.32	0.105	28	0.45	0.127	19
Males	0.75	0.161	10	0.40	0.185	9	0.44	0.167	11

It should be noted that density of cottontails may affect adrenal and spleen weight:body weight ratios (Conaway and Wight, 1962). In our experiments, the stocking rates were equal in all pens each year. Recovery rates for rabbits at the end of the breeding seasons were generally higher in the control than in the experimental pens, but these differences were not statistically significant (see Table 7).

From the available data, we doubt that density affected the measures of stress that we used; however, we cannot completely rule out this possibility.

CONCLUSIONS AND DISCUSSION

The following principal points emerged from this study:

(1) Dieldrin behavior in soil--Dieldrin levels in soil samples taken a few months after application generally reflected the application levels. Dieldrin persisted from 1 year to the next in the soils of the pens treated annually. However, variable residue readings, attributable at least in part to experimental procedure, permitted no assessment of long-term accumuation of dieldrin in the treated pens. Annual carryover in the soil of organochlorine pesticides, including aldrin and dieldrin, has been demonstrated in other studies (reviewed by Korschgen, 1970). Persistence over periods of a few years has also been demonstrated previously, as has been the perplexing variability in soil residue levels long after application of dieldrin (see Caro and Taylor, 1971).

(2) Dieldrin residues in cottontail tissues--Residue levels in brain, liver, and muscle tissues of rabbits from pens subjected to dieldrin treatment were significantly higher than those of control animals. Tissue residue levels reflected residue levels in the soils of the treated pens.

(3) Mortality of adults--At the end of each year's experiment, lower percentages of stocked cottontails were recovered from the pens treated with dieldrin than from the control pens. These differences were not statistically significant ($P > 0.05$), but they may have been real: three animals found dead in treated pens had lethal brain residue levels, and a few others found dead showed some symptoms of dieldrin poisoning.

(4) Reproductive performance--No major differences were apparent in the reproductive performance of either female or male cottontails according to treatment.

(However, the data for females pertained only to second pregnancies; it is possible that effects would have been detected in subsequent litters following longer exposure.) These findings are concordant with other studies of the effects of dieldrin on mammals. For example, Murphy and Korschgen (1970) studied effects on reproduction in white-tailed deer (Odocoileus virginianus) fed 0, 5, and 25 ppm dieldrin. They found no consistent differences in conception rates and in mortality in utero among treatment groups. Fertility of male progeny was not affected. However, they showed a greater postpartum mortality of fawns from dieldrin-treated does. In the present study, there were no consistent differences in reproductive performance between wild-trapped rabbits stocked annually in the pens, 1966-69, and the rabbits breeding in 1971, born of captive parents.

Several studies besides that of Murphy and Korschgen (1970) have shown increased postnatal mortality of mammals born to females treated with organochlorines. For example, Morris (1968) studied the effects of feeding endrin (0-7 ppm) on survival and reproduction in the deer mouse (Peromyscus maniculatus). Frequency of litter production and mean litter size were similar for each group before and during experimental feeding. Increased postnatal mortality before weaning was observed among the treated animals. He concluded that the postnatal period may be the crucial one for survival of young mammals subjected to pesticides.

Harr et al. (1970) reported reproductive data for 220 female Wistar rats fed a semipurified ration to which dieldrin was added. The maximal dietary exposure level of dieldrin consistent with reproductive values of normal rats was 0.24 ppm (0.014 ug/g of body weight per day). Exposure levels in excess of 0.24 ppm resulted in a lowered percentage of females that conceived, an increased concentration of dieldrin in the stomach milk curd of pups as compared with the ration fed the dam, and death of nursing pups.

In the present study, there was no adequate measure of postnatal mortality. Thus, a possibility remains that dieldrin application suppressed productivity of the cottontails, even though reproductive rates themselves, at least during second pregnancies, were apparently not affected.

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APPENDIX I

ANALYTICAL METHODOLOGY

Rabbit Tissue

Analyses for dieldrin were made at the WARF Institute, Inc., Madison, Wisconsin. All samples were stored frozen until time for analysis.

Tissues analyzed included brain, muscle, liver, testes, and fat. Samples from individual animals weighed approximately 5-10 grams, except for fat, which was 2-4 grams. Fat samples were taken from the supra-scapular region of the body; muscle samples were from the thigh. In some years, tissue samples from more than one animal from the same pen were combined and homogenized before analysis. Samples were then proportionately larger. The numbers of individuals represented in each sample are shown in the tables in Appendix II.

Samples were dried to constant weight in a 40 C oven for 72-96 hours, then ground with sodium sulfate and extracted with a mixture of ethyl and petroleum ether (70 ml:170 ml) for 8 hours in a Soxhlet apparatus. The extract was cleaned and separated into two fractions by elution through a florisil column with mixtures of ethyl and petroleum ether (5:95 and 15:85). Analysis was by electron capture gas chromatography on a Barber-Coleman Pesticide Analyzer Model 5360. Instrument conditions were: Column, 1.2 m x 4 mm glass, packed with 5% DC-200 on 80/100 mesh Gas Chrom Q; injector temperature 230 C, column 200 C, and detector 240 C; carrier gas, nitrogen; flow such that dieldrin had a retention time of 4-5 minutes.

No corrections were made for recovery, which was 85% or better. Lipids were determined on an aliquot of the extract reduced to dryness on a steambath and placed in a 40 C oven for 204 hours.

Soil

Analyses for dieldrin were made at the WARF Institute, Inc., Madison, Wisconsin. Samples were stored frozen until analysis.

The soil sample (approximately 800 grams) was passed through a mesh screen to remove stones and other foreign materials. A 20-gram portion was taken for analysis. The sample was extracted in a 1-quart Waring Blender with 200 ml acetonitrile, filtered through glass wool into a separatory funnel containing 600 ml of tap water, partitioned from acetonitrile into petroleum ether, dried with sodium sulfate, and passed through a florisil column as described for rabbit tissue. Subsequent steps and instrument conditions are also as described for rabbit tissue.

Soil moisture was determined for a separate 10-gram aliquot by heating in a vacuum oven at 100 C for 5 hours, then reweighing for moisture calculation.

Organic matter was measured in the same sample used for moisture determination; the dry sample was heated in a muffle furnace at 500 C for 4 hours, then reweighed for organic matter calculation.

pH was determined for a separate 5-gram sample and read to the nearest 0.1 pH unit on a Beckman Zeromatic II pH meter.

Plant Tissue

Analyses for dieldrin were made at the Bureau of Sport Fisheries and Wildlife, Fish-Pesticide Research Laboratory, Columbia, Missouri. Tissues analyzed included seed heads, blades, or blades plus stalks. All samples were stored frozen until time for analysis.

Two-gram samples were ground and dried with anhydrous sodium sulfate; extracted in a 1 cm ID glass column, with reservoir, with 100 ml of 5% diethyl ether in hexane; cleaned by eluting with 75 ml of diethyl ether and petroleum ether (5:95) through a 1 cm ID florisil column topped with sodium sulfate. Analysis was by electron capture gas chromatography on a Packard 804. Instrument conditions were: Column, 1.8 m x 2 mm, glass, packed with 0.3% OV-7 on 80/100 mesh glass beads; temperature was 180 C; carrier gas, nitrogen; flow 30 ml per min.

Table A. Reproductive performance of adult cottontails in untreated pens (controls) and pens treated with dieldrin. Data collected during time of second pregnancy in each season.

Rabbit no.	Wt (g)	Dieldrin treatment (lbs/acre)	Viable embryos	Approx. embryo ages (days)	Corpora lutea	Embryos resorbed	Lactation	Testis wt (g)	Body fat
				1966					
Females									
1545	1190.7	Control	6	24	6	1	no		None
1547	1445.8	"	8	24	8	0	no		None
1640	1190.7	"	4	17	6	1	yes		None
1644	1162.3	"	4	24	5	0	yes		None
1569	1190.7	"	0*	--	5	5	yes		None
1630	907.2	"	0*	--	?	Total	yes		None
1634	1077.3	"	3	14	3	0	no		None
1636	1190.7	"	4	16	6	2	yes		Light
1638	992.2	"	4	12	4	0	no		Light
1584	1247.4	"	7	14	7	0	no		None
1586	1247.4	"	6	15	6	0	no		Light
1588	1275.7	"	6	22	6	0	yes		None
Mean	1176.5		5.20 ± 0.425	18.2	5.64 ± 0.372				
Males									
1531	992.2	"						9.30	None
1567	1190.7	"						8.90	----
1573	1134.0	"						11.70	Light
1575	1134.0	"						6.25	None
1515	1275.7	"						9.06	Light
1525	1105.6	"						11.40	None
Mean	1139.6							9.44 ± 0.691	
Females									
1582	1247.4	0.5	7	21	7	0	no		Light
1596	-	"	4	15	5	0	yes		None
1614	1304.1	"	6	24	6	0	no		Light
1620	1247.4	"	7	23	7	0	yes		None
1523	1247.4	"	5	23	6	1	no		None
1616	1162.3	"	5	16	5	2	yes		Light
1628	1077.3	"	5	16	5	0	yes		Light
Mean	1213.3		5.57 ± 0.508	20.2	5.86 ± 0.466				

* Not included in mean number of viable embryos.

Table A. (continued)

Rabbit no.	Wt (g)	Dieldrin treatment (lbs/acre)	Viable embryos	Approx. embryo ages (days)	Corpora lutea	Embryos resorbed	Lactation	Testis wt (g)	Body fat
Males									
1557	1190.7	0.5						5.17	Light
1563	1020.6	"						10.15	Light
1618	963.9	"						9.60	Light
1511	1134.0	"						11.05	Light
C-3	1048.9	"						8.92	Light
1610	1048.9	"						6.90	None
Mean	1068.8							8.63 ± 0.691	
Females									
1503	1190.7	2.0	4	26	5	0	no		None
1507	1134.0	"	4	24	9	0	yes		None
1553	1389.1	"	7	16	7	0	no		Light
1555	1219.0	"	5	13	6	1	no		None
1650	1247.4	"	7	16	7	0	yes		None
Mean	1236.0		5.40 ± 0.601	19	6.80 ± 0.551				
Males									
1598	1048.9	"						8.40	None
1622	1048.9	"						9.57	Light
1543	992.2	"						9.50	Light
1656	1105.6	"						11.03	None
1505	1190.7	"						11.20	None
C-2	963.9	"						7.25	Light
C-1	878.8	"						6.44	None
Mean	1032.8							9.06 ± 0.640	
				1967					
Females									
3994	1275.7	Control	6	10	7	1	yes		Light
3954	1304.1	"	6	19	6	0	yes		None
Mean	1289.9		6.00 ± 0.950	14.5	6.50 ± 0.872				
Males									
3943	1048.9	"						10.15	None
3949	1134.0	"						11.22	None
Mean	1091.4							10.69 ± 1.197	

Table A. (continued)

Rabbit no.	Wt (g)	Dieldrin treatment (lbs/acre)	Viable embryos	Approx. embryo ages (days)	Corpora lutea	Embryos resorbed	Lactation	Testis wt (g)	Body fat
Females									
3940	1445.8	0.5	0*	--	6	4	yes		None
3937	1304.1	"	0*	--	6	6	yes		None
3921	1190.7	"	6	13	6	0	yes		None
2000	1162.3	"	6	19	8	2	yes		None
3956	1417.5	"	5	24	5	0	yes		None
3962	1275.7	"	5	13	6	0	yes		None
3941	1389.1	"	7	12	7	0	yes		None
3952	1304.1	"	2	9	5	3	no		None
Mean	1312.6		5.17 ± 0.548	15.0	6.13 ± 0.436				
Male									
3634	1020.6	"						8.25	None
Females									
2002	1134.0	2.0	-	--	0	-	--		Light
3976	1304.1	"	-	--	0	-	no		Heavy
3918	1077.3	"	6	14	6	0	yes		None
3931	1360.8	"	8	14	8	0	yes		None
3632	1474.2	"	5	14	7	0	yes		None
Mean	1304.1		6.33 ± 0.776	14.0	7.00 ± 0.712				
Males									
3933	1190.7	"						9.31	None
3651	1247.4	"						9.20	None
3920	1162.3	"						8.22	None
Mean	1199.2							8.91 ± 0.977	
				1969					
Females									
1449-50	1360.8	Control	(pp)**	--	8	-	no		None
1445-46	1077.3	"	5	21	5	0	yes		None
1485-86	-	"	6	21	6	0	yes		Medium
5-1	1332.4	"	(pp)	--	7	-	yes		Light
2907-08	1247.4	"	5	14	6	0	no		Light
2919-20	1275.7	"	6	22	7	0	yes		Light

** Postpartum pregnancy; embryos not sufficiently developed for counting.
* Not included in mean number of viable embryos.

Table A. (continued)

Rabbit no.	Wt (g)	Dieldrin treatment (lbs/acre)	Viable embryos	Approx. embryo ages (days)	Corpora lutea	Embryos resorbed	Lactation	Testis wt (g)	Body fat
Females (continued)									
2917-18	1275.7	Control	(pp)	--	8	-	yes		None
2913-14	1190.7	"	(pp)	--	4	-	yes		None
2938-39	1275.7	"	5	21	7	0	yes		None
1347-48	1360.8	"	7	14	6	0	no		None
2053	1360.8	"	(pp)	--	6	-	yes		Light
1336-37	1304.1	"	(pp)	--	6	-	yes		None
1324-25	1332.4	"	(pp)	--	10	-	yes		None
1332-33	1389.1	"	(pp)	--	9	-	yes		Light
1316-17	1304.1	"	(pp)	--	7	-	yes		None
1322-23	1360.8	"	(pp)	--	6	-	yes		Light
Mean	1295.6		5.67 ± 0.548	18.8	6.67 ± 0.318				
Males									
2934-35	1134.0	"						7.89	Light
1425-26	1048.9	"						10.27	Light
1334-35	1134.0	"						7.99	None
1479-80	1048.9	"						10.00	Light
12-1	1020.6	"						8.46	Light
1348-49	1077.3	"						8.30	Light
1354-55	1105.6	"						9.40	Light
1481-82	1134.0	"						11.38	None
1352-53	1048.9	"						8.02	Light
2885-86	1105.6	"						9.99	Light
1344-45	935.5	"						10.41	None
1330-31	963.9	"						11.12	None
1483-84	963.9	"						8.38	None
1319-20	1134.0	"						9.11	None
Mean	1061.1							9.34 ± 0.452	
Females									
2967-68	1219.0	0.5	(pp)	--	5	-	no		Light
1360-61	1360.8	"	(pp)	--	8	-	no		None
1429-30	1360.8	"	(pp)	--	8	-	yes		None
1400-01	1502.5	"	(pp)	--	7	-	yes		None
2963-64	1360.8	"	(pp)	--	7	-	yes		Light
1930	1360.8	"	2	--	6	3	no		Light
1368-69	1360.8	"	6	--	9	0	yes		None
2932-33	1474.2	"	5	--	9	0	yes		Light

Table A. (continued)

Rabbit no.	Wt (g)	Dieldrin treatment (lbs/acre)	Viable embryos	Approx. embryo ages (days)	Corpora lutea	Embryos resorbed	Lactation	Testis wt (g)	Body fat
Females	(continued)								
6-2	1360.8	0.5	(pp)	--	9	-	yes		None
2959-60	1048.9	"	5	--	6	0	no		Light
2953-54	1445.8	"	(pp)	--	8	-	yes		Light
1362-63	1502.5	"	6	--	7	0	yes		None
1378-79	1389.1	"	7	--	7	0	yes		None
866-67	1559.2	"	5	--	5	0	yes		Light
Mean	1378.9		5.14 ± 0.508		7.21 ± 0.330				
Males									
6-1	1048.9	"						9.77	Light
1406-07	1134.0	"						7.68	Light
1427-28	1105.6	"						10.55	Light
1358-59	1020.6	"						10.32	None
2911-12	1048.9	"						11.26	Light
1489-90	963.9	"						10.32	None
2905-06	1162.3	"						8.89	Light
2909-10	1077.3	"						8.97	None
1372-73	1077.3	"						9.56	None
1374-75	1048.9	"						8.62	None
Mean	1068.8							9.59 ± 0.535	
Females									
478-79	1360.8	2.0	7	--	11	0	yes		None
1381-82	1247.4	"	4	--	5	0	no		Medium
1599-1600	1360.8	"	6	--	6	0	yes		None
1-2	1134.0	"	7	--	10	0	yes		None
1310-11	1360.8	"	6	--	10	0	yes		Light
1387-89	1219.0	"	8	--	11	0	yes		Heavy
1312-13	1445.8	"	5	--	5	0	yes		Medium
1-1	1360.8	"	(pp)	--	7	-	yes		Light
1597-98	1417.5	"	8	--	7	0	yes		None
1301	1190.7	"	7	--	7	0	yes		None
1410-11	1332.4	"	(pp)	--	9	-	yes		Light
1414-15	1275.7	"	7	--	7	0	yes		None
489-90	1304.1	"	6	--	6	0	yes		None
1467-68	1275.7	"	9	--	9	0	yes		None

Table A. (continued)

Rabbit no.	Wt (g)	Dieldrin treatment (lbs/acre)	Viable embryos	Approx. embryo ages (days)	Corpora lutea	Embryos resorbed	Lactation	Testis wt (g)	Body fat
Females	(continued)								
1402-03	1219.0	2.0	5	--	7	0	no		None
1421	1332.4	"	7	--	10	0	yes		None
Mean	1302.4		6.57 ± 0.359		7.94 ± 0.308				
Males									
1404-05	963.9	"						9.98	None
1314-15	935.5	"						11.01	None
1443-44	1219.0	"						8.29	Light
1308-09	1134.0	"						10.31	Light
1326-27	963.9	"						9.46	Medium
1392-93	1048.9	"						8.74	None
Mean	1044.1							9.63 ± 0.691	
				1971					
Females									
305-06	1587.5	Control	6	24	6	0	no		None
302	1417.5	"	5	24	6	0	no		Medium
315-16	1814.3	"	8	10	8	0	yes		None
307-08	1672.6	"	6	10	8	0	yes		None
311-12	1644.2	"	6	10	6	0	yes		None
3264-65	1615.9	"	(pp)	--	7	-	no		None
309-10	1474.2	"	5	16	5	0	no		None
313-14	1672.6	"	6	24	6	0	no		Light
289-90	1559.2	"	5	--	5	2	no		None
273-74	1332.4	"	5	10	7	0	yes		None
255-56	1105.6	"	3	10	4	0	no		Medium
281-82	1389.1	"	5	10	6	0	yes		Light
283-84	1360.8	"	(pp)	--	5	0	yes		None
288	1672.6	"	5	10	6	0	yes		None
253-54	1134.0	"	6	--	6	0	yes		Light
285	1417.5	"	5	10	6	0	yes		None
277-78	1219.0	"	7	--	7	0	yes		Light
267-68	1417.5	"	8	10	6	0	yes		None
138-39	1502.5	"	6	10	6	0	yes		None
129-30	1332.4	"	5	10	5	0	yes		None
3200-126	1559.2	"	6	10	6	0	yes		None
144-45	1445.8	"	5	10	5	0	yes		Light
186-87	1587.5	"	(pp)	--	5	-	yes		None

Table A. (continued)

Rabbit no.	Wt (g)	Dieldrin treatment (lbs/acre)	Viable embryos	Approx. embryo ages (days)	Corpora lutea	Embryos resorbed	Lactation	Testis wt (g)	Body fat
Females (continued)									
3270-71	1445.8	Control	1	16	6	2	no		Medium
3280-81	1587.5	"	(pp)	--	6	-	no		None
178-79	1275.7	"	5	10	5	0	yes		Light
3278-79	1360.8	"	5	10	5	0	yes		None
3268-69	1389.1	"	4	10	5	0	yes		None
3277-78	1559.2	"	5	24	5	0	no		None
Mean	1467.3		5.32 ± 0.269	13.1	5.83 ± 0.229				
Males									
304	1417.5	"						13.24	Medium
3263	1134.0	"						8.80	Light
3260-61	1304.1	"						9.32	None
295-96	1304.1	"						11.19	Light
269-70	1020.6	"						7.05	None
257-58	1275.7	"						11.30	Light
261-62	1219.0	"						9.17	Light
3188-89	1219.0	"						7.80	Light
176-77	1134.0	"						8.09	None
279-80	1219.0	"						8.26	Light
Mean	1224.7							9.42 ± 0.535	
Females									
68-69	1502.5	0.5	4	10	6	1	yes		Light
243-44	1644.2	"	7	24	7	0	yes		None
251-52	1389.1	"	5	24	5	0	yes		None
241-42	1587.5	"	5	24	6	0	no		None
237	1389.1	"	6	10	7	0	yes		None
247-48	1502.5	"	5	16	5	0	yes		None
249-50	1389.1	"	4	24	7	1	no		Medium
225-26	1275.7	"	5	24	5	0	no		None
239-40	1587.5	"	5	--	6	0	no		Light
166-67	1445.8	"	4	10	5	0	yes		Light
170-71	1275.7	"	5	10	4	1	yes		None
154-55	1502.5	"	6	24	6	0	no		None
146-47	1729.3	"	7	10	7	1	yes		None
148-49	1417.5	"	5	10	5	2	yes		None
3426-37	1530.9	"	5	--	5	0	yes		None

Table A. (continued)

Rabbit no.	Wt (g)	Dieldrin treatment (lbs/acre)	Viable embryos	Approx. embryo ages (days)	Corpora lutea	Embryos resorbed	Lactation	Testis wt (g)	Body fat
Females	(continued)								
3450-51	1389.1	0.5	(pp)	--	6	-	yes		None
3432-33	1360.8	"	5	--	6	0	yes		None
3444-45	1389.1	"	6	16	7	0	yes		None
3442	1417.5	"	1	10	5	0	yes		None
3424-25	1360.8	"	6	16	5	0	no		Light
3452-53	1587.5	"	3	24	7	0	yes		None
3454-55	1445.8	"	5	16	5	0	yes		Heavy
3441	1587.5	"	3	16	6	0	yes		None
56-57	1445.8	"	5	10	5	0	yes		None
54-55	1842.7	"	6	10	7	0	yes		None
52-53	1190.7	"	5	--	5	0	-		None
64-65	1644.2	"	6	24	6	0	no		None
43-44	1445.8	"	4	--	5	1	no		Light
62-63	1474.2	"	4	24	5	0	no		Light
74-75	1502.5	"	0	--	5	4	yes		Light
58-59	1530.9	"	(pp)	--	5	-	yes		Light
Mean	1477.0		4.89 ± 0.254	16.8	5.68 ± 0.221				
Males									
60-61	1247.4	"						8.58	Light
76-77	1360.8	"						10.16	Light
229-30	1389.1	"						12.16	Light
233-34	1105.6	"						9.40	Light
235-36	1048.9	"						7.87	Light
174-75	1134.0	"						9.43	None
3431	1275.7	"						12.94	Light
3426-27	1247.4	"						12.20	None
3422-23	1162.3	"						11.57	Medium
3435	1020.6	"						6.45	Medium
47-48	1247.4	"						11.38	None
Mean	1203.7							10.20 ± 0.510	
Females									
211-12	1389.1	2.0	7	10	7	0	no		Heavy
2460-61	1360.8	"	4	10	4	0	no		None
3492-93	1672.6	"	6	10	6	0	yes		None
3416-17	1474.2	"	6	24	5	0	no		Light

Table A. (continued)

Rabbit no.	Wt (g)	Dieldrin treatment (lbs/acre)	Viable embryos	Approx. embryo ages (days)	Corpora lutea	Embryos resorbed	Lactation	Testis wt (g)	Body fat
Females (continued)									
82-83	1474.2	2.0	6	24	6	0	yes		Light
92-93	1162.3	"	2	24	4	0	no		Light
3406-07	1474.2	"	6	10	6	0	yes		None
94-95	1587.5	"	5	24	5	0	yes		None
84-85	1786.0	"	5	24	7	0	yes		Light
3412	1417.5	"	5	24	6	0	no		None
5-6	1587.5	"	7	10	7	0	yes		None
7-8	1190.7	"	7	10	7	0	yes		None
221-22	1587.5	"	5	24	7	2	no		Light
206-07	1559.2	"	5	10	7	0	yes		None
204-05	1445.8	"	6	10	6	0	yes		None
198-99	1304.1	"	5	10	5	0	yes		None
202-03	1219.0	"	5	24	5	0	yes		Light
196-97	1530.9	"	6	--	6	0	no		None
213-14	1190.7	"	6	10	6	0	no		Light
Mean	1443.0		5.47 ± 0.308	16.6	5.90 ± 0.283				
Males									
200-01	1190.7	"						6.09	Light
3468	1190.7	"						11.97	None
3456-57	1247.4	"						10.35	Light
3462-63	1275.7	"						13.38	None
96-97	1190.7	"						8.21	None
3408-09	1304.1	"						9.37	Medium
98-99	1219.0	"						7.48	None
33-34	1077.3	"						10.92	None
188-89	1332.4	"						9.66	None
192-93	1134.0	"						10.12	Light
190-91	1304.1	"						10.10	Light
Mean	1224.1							9.79 ± 0.510	

Table B. Dieldrin residues in brain (B), liver (L), muscle (M), testes (T), and fat (F) of adult cottontails in untreated pens (controls) and pens treated with dieldrin. (Numbers of individual samples comprising pools are shown in Table 8.)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid wt in sample (g)	ppm dieldrin Wet	Dry	Lipid
				1966 INDIVIDUAL DATA*						
1644-B	Control	F	4.79	74.1	1.24	8.4	0.402	0.062	0.24	0.74
1569-B	"	F	6.97	73.9	1.82	8.7	0.606	<0.01	-	-
								<0.036 ±0.028	0.120	0.370
1531-B	"	M	6.61	74.9	1.66	8.3	0.549	<0.01	-	-
1573-B	"	M	5.42	75.2	1.34	7.9	0.428	<0.01	-	-
								<0.01	-	-
1644-L	"	F	10.20	78.7	2.17	2.0	0.204	0.090	0.42	4.50
1569-L	"	F	10.00	67.8	3.22	1.9	0.19	0.076	0.24	4.00
								0.083 ±0.007	0.330	4.250
1531-L	"	M	10.00	67.1	3.29	2.8	0.28	0.059	0.18	2.11
1573-L	"	M	10.00	67.5	3.25	1.8	0.18	0.063	0.19	3.50
								0.061 ±0.002	0.185	2.805
1644-M	"	F	10.30	74.2	2.66	0.26	0.027	<0.01	-	-
1569-M	"	F	10.00	75.0	2.50	0.27	0.027	<0.01	-	-
								<0.01	-	-
1531-M	"	M	10.00	74.9	2.51	1.0	0.10	<0.01	-	-
1573-M	"	M	10.00	72.7	2.73	1.8	0.18	<0.01	-	-
								<0.01	-	-
1531-T	"	M	7.21	79.8	1.46	2.6	0.187	<0.01	-	-
1573-T	"	M	10.20	77.5	2.30	5.3	0.541	<0.01	-	-
								<0.01	-	-
1573-F	"	M	3.24	18.8	2.63	53.4	1.73	<0.01	-	-
								<0.01	-	-

* Sensitivity = 0.01 ppm.

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid wt in sample (g)	ppm dieldrin Wet	Dry	Lipid
1596-B	0.5	F	4.95	76.8	1.15	6.8	0.337	0.060	0.258	0.882
1624-B	"	F	6.10	76.8	1.42	8.0	0.488	0.094	0.40	1.18
1616-B	"	F	4.50	73.1	1.21	7.7	0.347	0.47	1.75	6.10
1582-B	"	F	4.53	72.4	1.25	8.1	0.367	0.25	0.91	3.09
								0.219 ±0.093	0.830	2.813
1610-B	"	M	4.87	74.5	1.24	8.3	0.404	0.19	0.75	2.29
1618-B	"	M	5.03	76.0	1.21	6.9	0.347	0.11	0.46	1.59
C-3-B	"	M	3.58	47.5	1.88	6.6	0.236	0.27	0.514	4.09
1557-B	"	M	4.85	70.8	1.42	8.0	0.388	0.16	0.547	2.00
								0.183 ±0.034	0.568	2.493
1596-L	"	F	10.20	63.7	3.70	3.0	0.306	2.2	6.07	73.33
1624-L	"	F	10.00	68.0	3.20	3.2	0.32	4.9	15.3	153.13
1616-L	"	F	9.97	66.2	3.37	3.0	0.299	7.0	20.72	233.33
1582-L	"	F	10.50	66.6	3.51	3.1	0.326	2.4	7.18	77.42
								4.125 ±1.138	12.318	134.302
1610-L	"	M	10.00	70.4	2.96	2.2	0.22	4.4	14.87	200.00
1618-L	"	M	10.00	67.0	3.30	2.8	0.28	2.7	8.18	96.42
C-3-L	"	M	9.97	65.1	3.48	2.7	0.269	9.7	27.84	359.26
1557-L	"	M	9.95	65.0	3.48	2.6	0.259	4.4	12.58	169.23
								5.300 ±1.520	15.868	206.227
1624-M	"	F	10.00	72.7	2.73	0.38	0.038	0.019	0.07	5.0
1616-M	"	F	9.96	74.5	2.54	0.49	0.049	0.077	0.30	15.71
1582-M	"	F	9.93	72.9	2.69	0.81	0.08	0.065	0.24	8.03
								0.054 ±0.018	0.203	9.580
1610-M	"	M	9.95	65.1	2.48	0.38	0.038	0.034	0.14	8.95
C-3-M	"	M	10.20	73.0	2.75	0.58	0.059	0.043	0.160	7.41
1557-M	"	M	9.98	74.2	2.58	0.65	0.064	0.032	0.124	4.92
								0.036 ±0.003	0.141	7.093

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid wt in sample (g)	ppm dieldrin Wet	Dry	Lipid
1610-T	0.5	M	5.85	81.2	1.10	2.4	0.140	0.20	1.06	8.33
1618-T	"	M	5.20	78.5	1.12	2.6	0.135	0.11	0.51	4.23
C-3-T	"	M	11.2	75.5	2.74	4.8	0.538	0.046	0.188	0.958
1557-T	"	M	5.26	73.4	1.40	7.5	0.395	1.4	5.26	18.67
								0.439	1.755	8.047
1616-F	"	F	3.85	18.1	3.15	68.0	2.62	13.0	15.90	19.12
1582-F	"	F	3.90	16.1	3.27	60.8	2.37	8.9	10.59	14.64
								10.950	13.245	16.880
1618-F	"	M	2.54	24.8	1.91	51.4	1.31	4.9	6.52	9.53
C-3-F	"	M	3.69	19.0	2.99	72.1	2.66	9.5	11.69	13.18
1557-F	"	M	3.17	18.5	2.58	56.9	1.80	6.8	8.36	11.95
								7.067	8.857	11.553
1553-B	2.0	F	4.97	75.2	1.23	7.0	0.35	0.40	1.62	5.68
1503-B	"	F	4.91	74.2	1.27	7.5	0.368	0.64	2.48	8.54
1507-B	"	F	4.67	73.1	1.26	8.4	0.392	0.37	1.37	4.41
1650-B	"	F	4.88	75.3	1.21	7.0	0.342	0.27	1.09	3.86
								0.420 ±0.078	1.640	5.623
1598-B	"	M	4.78	76.6	1.12	6.8	0.33	0.56	2.39	8.12
C-1-B	"	M	4.41	75.7	1.07	7.6	0.335	0.20	0.82	2.63
1505-B	"	M	4.48	71.4	1.28	10.4	0.466	0.41	1.44	3.94
								0.390 ±0.104	1.550	4.897
1553-L	"	F	10.40	67.6	3.37	2.7	0.28	8.3	25.65	308.0
1503-L	"	F	10.00	68.3	3.17	3.2	0.32	12.0	37.9	375.4
1507-L	"	F	9.98	67.5	3.24	3.4	0.339	6.7	20.64	194.0
1650-L	"	F	10.00	68.5	3.15	2.4	0.24	4.3	13.67	179.0
								7.825 ±1.616	24.465	264.100
1598-L	"	M	10.00	67.0	3.30	2.7	0.27	9.3	28.18	344.0
1622-L	"	M	10.10	68.3	3.20	2.6	0.262	7.9	24.96	304.4
C-1-L	"	M	9.97	62.9	3.70	2.3	0.229	4.3	11.60	187.0
1505-L	"	M	9.79	67.9	3.14	2.1	0.206	3.9	12.17	185.71
								6.350 ±1.333	19.227	255.277

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid wt in sample (g)	ppm dieldrin Wet	Dry	Lipid
1553-M	2.0	F	10.10	74.8	2.55	0.64	0.065	0.13	0.52	20.2
1503-M	"	F	9.94	75.4	2.45	0.40	0.039	0.12	0.49	30.6
1507-M	"	F	9.94	74.1	2.58	0.41	0.040	0.071	0.27	17.65
1650-M	"	F	9.93	74.2	2.56	0.29	0.028	0.030	0.12	10.63
								0.088 ±0.023	0.350	19.770
1598-M	"	M	9.98	76.0	2.40	0.43	0.043	0.40	1.66	92.8
1622-M	"	M	9.87	74.3	2.54	0.40	0.039	0.041	0.16	10.40
C-1-M	"	M	10.00	76.7	2.33	1.1	0.11	0.092	0.40	8.36
1505-M	"	M	9.92	76.3	2.35	0.37	0.037	0.063	0.27	17.03
								0.149 ±0.084	0.623	32.148
1598-T	"	M	6.91	77.6	1.55	4.5	0.311	1.3	5.80	28.9
1622-T	"	M	9.10	80.3	1.80	4.0	0.364	0.81	4.10	20.2
C-1-T	"	M	6.20	78.7	1.32	3.4	0.211	0.39	1.83	11.47
1505-T	"	M	9.82	78.9	2.07	3.8	0.373	0.72	3.41	18.95
								0.805	0.785	19.880
1553-F	"	F	3.96	14.9	3.37	78.5	3.11	24.0	28.32	30.6
								24.0	28.32	30.6
1598-F	"	M	2.08	21.2	1.64	48.0	0.998	17.0	21.59	35.4
1622-F	"	M	3.22	18.4	2.63	50.2	1.62	12.0	14.64	23.2
								14.500	18.115	29.300
				1967 POOLED DATA						
3994-3954-3892-B	Control	F	8.42	70.1	2.51	10.26	.864	0.01	-	-
								0.01	-	-
3949-3943-2001-B	"	M	8.02	74.9	2.01	8.43	.676	0.01	-	-
								0.01	-	-
3994-3954-3892-L	"	F	16.64	67.0	5.49	3.15	.524	0.049	0.148	1.555
								0.049	0.148	1.555

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
3943-2001-L	Control	M	23.05	63.7	8.38	1.86	.429	0.11	2.750	5.913
								0.11	2.750	5.913
3994-3954-3892-M	"	F	20.00	73.7	5.25	.355	.071	0.01	-	-
								0.01	-	-
3949-3943-2001-M	"	M	20.00	74.5	5.10	.320	.064	0.01	-	-
								0.01	-	-
3941-3957-B	0.5	F	14.35	76.2	3.42	7.98	1.145	0.057	0.239	0.714
2000-3956-B	"	F	11.89	74.4	3.04	8.63	1.026	0.078	0.305	0.903
3940-3958-B	"	F	12.29	74.6	3.12	8.20	1.008	0.048	0.189	0.585
3962-3921-B	"	F	14.66	74.7	3.71	8.69	1.274	0.034	0.134	0.391
3937-B	"	F	7.13	74.6	1.81	8.16	.582	0.028	0.110	0.343
								0.049 ±0.008	0.195	0.587
3634-B	"	M	6.55	73.9	1.71	8.20	.537	0.069	0.264	0.841
								0.069	0.264	0.841
3940-3956-L	"	F	20.00	69.4	6.12	2.00	.401	1.17	3.826	58.50
3934-3958-L	"	F	19.99	68.7	6.26	2.52	.504	0.91	2.903	36.111
2000-3962-L	"	F	19.98	68.0	6.39	2.81	.561	0.91	2.839	32.384
								0.997 ±0.142	3.189	42.332
2000-3962-M	"	F	20.00	73.1	5.37	.325	.065	0.01	-	-
3956-3921-M	"	F	19.99	74.5	5.08	.445	.089	0.021	0.082	4.719
3940-3942-M	"	F	20.00	74.0	5.19	.420	.084	0.01	-	-
3934-3850-M	"	F	19.99	74.9	5.01	.390	.078	0.01	-	-
								0.013 ±0.004	0.021	1.180
3634-M	"	M	25.24	75.0	6.31	.304	.077	0.01	-	-
								0.01	-	-
3555-3918-B	2.0	F	9.73	73.2	2.60	8.263	.804	0.069	0.258	0.835
3931-3976-B	"	F	12.56	72.1	3.50	9.402	1.181	0.14	0.502	1.489
3632-B	"	F	5.61	74.7	1.42	8.894	.499	0.35	1.382	3.935
								0.186 ±0.044	0.714	2.086

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
3920-3932-B	2.0	M	13.89	72.8	3.78	9.445	1.312	0.15	0.551	1.588
3651-B	"	M	7.35	73.5	1.95	9.360	.688	0.075	0.282	0.801
								0.113 ±0.042	0.417	1.195
3555-3918-L	"	F	20.18	68.6	6.33	3.08	.622	8.52	27.178	276.623
3931-3632-L	"	F	19.99	67.3	6.53	2.23	.446	1.17	3.580	52.466
3976-L	"	F	26.84	64.0	9.65	3.19	.857	5.36	14.900	168.025
								5.017 ±1.749	15.219	165.705
3651-3933-L	"	M	20.00	67.9	6.41	2.49	.497	3.59	11.200	144.176
3920-L	"	M	23.81	66.4	8.01	2.23	.532	3.41	10.128	152.914
								3.500 ±0.639	10.664	148.545
3931-3555-M	"	F	19.99	74.5	5.10	.375	.075	0.10	0.391	26.666
3918-3632-M	"	F	19.99	74.2	5.14	.390	.078	0.01	-	-
								0.052 ±0.030	0.196	13.333
3920-3932-M	"	M	20.00	74.3	5.13	.445	.089	0.021	0.081	4.700
3651-M	"	M	19.98	74.8	5.03	.500	.100	0.023	0.091	4.600
								0.022 ±0.003	0.086	4.650
3976-F	"	F	5.00	7.8	4.71	73.40	3.67	21.30	22.578	29.019
								21.30	22.578	29.019
				1968 INDIVIDUAL DATA						
3-1-B	Control	F	5.58	74.7	1.41	8.02	.448	0.01	-	-
2054-B	"	F	5.04	76.0	1.21	8.43	.425	0.01	-	-
2059-B	"	F	7.68	76.4	1.81	8.28	.636	0.01	-	-
2057-B	"	F	5.42	73.6	1.43	9.22	.500	0.01	-	-
2052-B	"	F	5.82	75.4	1.43	8.98	.523	0.01	-	-
								0.01	-	-

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
1948-B	Control	M	6.61	75.7	1.61	8.16	.540	0.01	-	-
11-1-B	"	M	5.83	75.8	1.41	7.56	.441	0.01	-	-
1946-B	"	M	6.70	74.9	1.68	7.11	.477	0.01	-	-
1937-B	"	M	5.05	75.7	1.23	8.51	.430	0.01	-	-
								0.01	-	-
3-1-L	"	F	11.62	69.8	3.51	2.83	.330	0.01	-	-
2054-L	"	F	4.50	72.0	1.26	4.62	.208	.056	.20	1.21
2059-L	"	F	6.78	68.2	2.16	2.43	.165	.057	.18	2.34
2057-L	"	F	12.59	67.0	4.16	2.58	.326	.052	.16	2.01
2052-L	"	F	3.00	66.9	.992	2.63	.079	.083	.25	3.15
								0.052 ±0.013	0.518	1.742
1948-L	"	M	12.88	69.0	3.99	2.15	.278	0.055	0.18	2.55
11-1-L	"	M	13.30	67.8	4.28	2.41	.321	0.093	0.29	3.85
1946-L	"	M	17.22	70.4	5.10	1.88	.324	0.049	0.17	2.60
1937-L	"	M	6.14	67.3	2.01	2.93	.180	0.088	0.27	3.00
								0.071 ±0.011	0.228	3.000
3-1-M	"	F	8.72	73.4	2.32	.68	.060	0.013	0.05	1.91
2054-M	"	F	2.68	75.4	.66	2.53	.068	0.01	-	-
2059-M	"	F	24.38	72.7	6.67	.37	.091	0.01	-	-
2057-M	"	F	10.12	77.8	2.25	.54	.055	0.01	-	-
2052-M	"	F	5.06	76.1	1.21	.23	.012	0.01	-	-
								0.011 ±0.002	0.010	0.382
1948-M	"	M	8.30	74.5	2.12	.51	.043	0.01	-	-
11-1-M	"	M	13.27	76.6	3.11	.63	.084	0.01	-	-
1946-M	"	M	12.75	70.0	3.82	4.21	.537	0.01	-	-
1937-M	"	M	10.00	74.6	2.54	.42	.042	0.01	-	-
								0.01	-	-
3-1-F	"	F	6.74	7.0	6.27	89.64	6.042	0.083	0.09	0.09
								0.083	0.09	0.09
1946-F	"	M	2.02	16.3	1.69	67.42	1.362	0.01	-	-
								0.01	-	-

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
2037-B	0.5	F	7.19	76.5	1.69	8.06	.580	0.090	0.38	1.11
1939-B	"	F	5.33	75.4	1.31	6.96	.371	0.20	0.80	2.87
1945-B	"	F	5.31	75.7	1.29	6.62	.352	0.25	1.03	3.77
362-B	"	F	6.83	75.9	1.65	8.03	.549	0.12	0.50	1.49
1907-B	"	F	6.70	76.3	1.59	6.94	.465	0.65	2.74	9.36
								0.262 ±0.101	1.090	3.720
1906-B	"	M	6.99	73.4	1.86	7.86	.550	0.11	0.41	1.39
357-B	"	M	2.61	73.6	.69	7.66	.200	0.11	0.42	1.43
								0.110 ±0.0	0.415	1.410
2037-L	"	F	3.77	66.3	1.27	3.07	.116	2.95	8.76	96.09
1939-L	"	F	4.79	67.6	1.55	2.40	.115	2.40	7.42	100.00
1945-L	"	F	5.42	71.0	1.57	2.02	.110	2.51	8.67	124.25
362-L	"	F	11.52	71.8	3.25	1.99	.230	1.11	3.93	55.77
1907-L	"	F	10.66	68.6	3.35	2.96	.316	6.16	19.60	208.10
								3.026 ±0.841	9.676	116.842
1906-L	"	M	8.406	74.5	2.14	1.45	.122	1.84	7.23	126.89
357-L	"	M	8.91	67.9	2.86	2.32	.207	3.61	11.25	155.60
								2.725 ±0.885	9.240	141.245
2037-M	"	F	21.11	75.5	5.17	.31	.066	0.01	-	-
1939-M	"	F	4.55	75.6	1.11	.39	.018	0.042	0.17	10.76
1945-M	"	F	6.50	74.6	1.65	.29	.019	0.040	0.16	13.79
362-M	"	F	20.91	74.8	5.26	.41	.086	0.030	0.12	7.31
1907-M	"	F	7.99	76.5	1.88	.38	.031	0.094	0.40	24.73
								0.043 ±0.015	0.017	11.318
1906-M	"	M	10.80	73.1	2.90	1.64	.178	0.13	0.48	7.92
357-M	"	M	10.07	74.9	2.53	.56	.057	0.093	0.37	16.60
								0.112 ±0.019	0.425	12.260

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
2028-B	2.0	F	7.19	75.9	1.73	7.53	.542	0.11	0.46	1.46
2029-B	"	F	7.13	76.0	1.71	7.51	.536	0.20	0.83	2.66
359-B	"	F	7.54	75.7	1.83	9.15	.690	0.36	1.48	3.93
2027-B	"	F	6.18	77.0	1.42	7.29	.451	0.28	1.22	3.84
356-B	"	F	8.16	76.5	1.92	7.65	.625	1.03	4.38	13.46
9-9-B	"	F	5.39	75.9	1.30	7.47	.403	0.66	2.74	8.83
2035-2636-B	"	F	1.21	68.6	.380	10.90	.132	1.99	6.34	18.25
								0.661 ±0.251	2.493	7.490
353-B	"	M	6.32	73.3	1.69	8.98	.568	0.36	1.35	4.00
								0.36	1.35	4.00
2028-L	"	F	16.14	66.8	5.35	2.74	.443	2.71	8.18	98.90
2029-L	"	F	12.13	70.4	3.59	2.16	2.63	1.65	5.58	76.38
359-L	"	F	22.67	73.1	6.10	1.48	.336	2.14	7.95	144.59
2027-L	"	F	8.91	67.7	2.88	2.21	.197	3.39	10.49	153.39
356-L	"	F	8.76	67.2	2.87	3.32	.291	12.6	38.46	379.51
9-9-L	"	F	6.56	71.3	1.88	2.68	.176	5.43	18.95	202.61
2035-2636-L	"	F	3.66	66.9	1.21	1.20	.044	2.39	7.23	199.16
								4.330 ±1.455	13.834	179.220
353-L	"	M	14.24	71.8	4.01	1.86	.266	6.69	23.76	359.67
								6.69	23.76	359.67
2028-M	"	F	22.10	73.9	5.76	.42	.094	.029	.11	6.90
2029-M	"	F	13.53	76.1	3.23	.32	.044	.028	.12	8.75
359-M	"	F	19.91	76.6	4.66	.22	.045	.025	.11	11.36
2027-M	"	F	8.20	73.9	2.14	.47	.039	.083	.32	17.65
356-M	"	F	12.14	75.7	2.95	.22	.027	.085	.35	38.63
9-9-M	"	F	20.63	72.3	5.71	1.80	.372	.71	2.57	39.44
2035-2636-M	"	F	4.66	71.7	1.32	.10	.055	.081	.29	81.00
								0.149 ±0.094	0.553	29.104
353-M	"	M	12.16	75.5	2.98	.41	.051	.062	.25	15.12
								.062	.25	15.12

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
2028-F	2.0	F	6.89	13.1	5.99	83.30	5.740	7.10	8.17	8.52
2027-F	"	F	1.10	15.5	.93	69.00	.759	14.2	16.79	20.57
9-9-F	"	F	4.97	10.5	4.45	89.75	4.461	38.6	43.11	43.00
								19.967	22.690	24.030
				1969 POOLED DATA**						
1465-1449-1445-B	Control	F	18.03	78.1	3.95	9.38	1.692	0.005	-	-
1554-1485-B	"	F	5.25	75.4	1.29	7.63	.401	0.005	-	-
5-1-2907-2919-B	"	F	15.80	76.5	3.71	7.21	1.140	0.005	-	-
2917-2913-2938-B	"	F	15.49	78.3	3.36	9.03	1.400	0.005	-	-
1340-1347-B	"	F	12.50	75.8	3.03	7.57	.974	0.005	-	-
2053-B	"	F	6.42	76.2	1.53	8.61	.553	0.005	-	-
1336-1324-1332-B	"	F	21.24	67.8	6.84	7.79	1.655	0.005	-	-
1316-1322-B	"	F	11.10	77.8	2.46	8.58	.953	0.005	-	-
								0.005	-	-
2934-1425-2885-B	"	M	16.46	76.8	3.82	8.98	1.479	0.005	-	-
1483-1479-1481-B	"	M	15.21	75.7	3.70	7.63	1.162	0.005	-	-
1354-1344-B	"	M	10.10	76.5	2.37	8.39	.847	0.012	0.051	0.143
1352-1348-B	"	M	12.83	76.5	3.01	7.36	.945	0.005	-	-
1330-1334-B	"	M	12.42	76.6	2.91	2.12	.264	0.005	-	-
1319-12-1-B	"	M	12.38	78.4	2.68	9.22	1.142	0.005	-	-
								0.006 ±0.002	0.009	0.024
1465-1449-1445-L	"	F	19.55	70.2	5.82	4.53	.886	0.26	0.87	5.74
1554-1485-L	"	F	15.97	68.1	5.10	2.49	.399	1.96	6.14	78.71
5-1-2907-2919-L	"	F	21.52	71.5	6.14	3.32	.715	0.20	0.70	6.02
2917-2913-2938-L	"	F	26.13	73.9	6.81	2.14	.561	0.090	0.35	4.21

** Sensitivity = 0.005 ppm.

Table B (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
1340-1347-L	Control	F	12.48	72.0	3.50	2.71	.339	0.083	0.30	3.06
2053-L	"	F	5.59	67.3	1.83	1.18	.066	0.040	0.12	3.39
1336-1324-1332-L	"	F	24.91	70.9	7.24	3.05	.760	0.060	0.21	1.96
1316-1322-L	"	F	16.42	67.8	5.28	3.00	.494	0.090	0.28	3.00
								0.348 ±0.135	1.109	13.261
2934-1425-2885-L	"	M	21.65	67.7	6.99	1.81	.394	0.25	0.77	13.81
1483-1479-1481-L	"	M	24.17	69.5	7.38	2.85	.689	0.34	1.11	11.92
1354-1344-L	"	M	16.93	70.5	5.00	2.26	.384	0.11	0.37	4.86
1352-1348-L	"	M	17.88	67.8	5.75	1.55	.278	0.13	0.40	8.38
1330-1334-L	"	M	13.26	68.3	4.20	2.22	.295	0.14	0.44	6.30
1319-12-1-L	"	M	14.14	71.7	4.00	2.85	.403	0.11	0.39	3.85
								0.180 ±0.035	0.580	8.187
1465-1449-1445-M	"	F	22.82	73.9	5.95	.60	.137	0.005	-	-
1554-1485-M	"	F	14.81	73.7	3.90	1.29	.192	0.005	-	-
5-1, 2907-2919-M	"	F	20.11	71.8	5.68	.68	.137	0.005	-	-
2917-2913-2938-M	"	F	22.49	74.4	5.75	.67	.151	0.005	-	-
1340-1347-M	"	F	15.59	73.8	4.08	.59	.093	0.005	-	-
2053-M	"	F	27.17	72.5	7.48	1.45	.396	0.005	-	-
1336-1324-1332-M	"	F	18.57	75.0	4.65	.31	.059	0.005	-	-
1316-1322-M	"	F	12.80	75.4	3.15	.32	.041	0.005	-	-
								0.005	-	-
2934-1425-2885-M	"	M	19.93	73.3	5.33	.64	.128	0.005	-	-
1483-1479-1481-M	"	M	20.30	72.2	5.65	1.00	.203	0.005	-	-
1354-1344-M	"	M	15.82	70.8	4.62	.67	.107	0.005	-	-
1352-1348-M	"	M	15.59	72.3	4.32	5.20	.811	0.005	-	-

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Lipid Percent in sample fat	Lipid (g)	ppm dieldrin Wet	Dry	Lipid
1330-1334-M	Control	M	14.59	75.1	3.63	.51	.075	0.005	-	-
1319-12-1-M	"	M	10.16	75.1	2.53	.64	.066	0.005	-	-
								0.005	-	-
1400-1423-1429-B	0.5	F	22.95	75.7	5.57	8.37	1.921	0.13	0.54	1.55
1930-B	"	F	5.68	75.5	1.39	7.50	.426	0.037	0.15	0.49
6-2-2932-B	"	F	11.83	76.2	2.81	7.78	.921	0.056	0.24	0.71
2951-866-B	"	F	14.93	76.4	3.52	9.43	1.409	0.054	0.23	0.57
2953-2971-2963-B	"	F	13.27	76.0	3.19	7.95	1.055	0.066	0.27	0.83
2961-2959-2967-B	"	F	14.34	76.7	3.34	7.92	1.137	0.12	0.52	1.51
2039-B	"	F	7.10	73.0	1.92	6.78	.482	0.16	0.59	2.35
1364-1360-1378-B	"	F	14.30	75.4	3.52	8.13	1.164	0.12	0.49	1.47
1362-1368-B	"	F	13.91	77.1	3.18	8.69	1.209	0.10	0.44	1.15
								0.094 ±0.012	0.386	1.181
1406-B	"	M	7.68	74.7	1.94	8.38	.644	0.10	0.40	1.19
6-1-1489-B	"	M	11.84	75.6	2.89	7.78	.922	0.12	0.49	1.54
1427-2909-B	"	M	9.63	76.1	2.30	7.70	.742	0.19	0.80	2.46
2911-2905-B	"	M	11.30	75.7	2.75	8.13	.919	0.14	0.58	1.72
1358-1372-1374-B	"	M	22.12	76.2	5.26	8.58	1.898	0.19	0.80	2.21
								0.148 ±0.024	0.614	1.824
1400-1424-1429-L	"	F	15.99	71.0	4.64	2.85	.456	3.01	10.37	105.61
1930-L	"	F	7.91	68.1	2.52	2.61	.207	1.41	4.43	54.02
6-2-2932-L	"	F	14.19	69.3	4.36	3.67	.521	2.03	6.61	55.31
2951-866-L	"	F	11.58	68.1	3.69	7.91	.916	.30	.94	3.79
2953-2971-2963-L	"	F	23.40	70.3	6.95	3.35	.784	3.12	10.51	93.13
2961-2959-2967-L	"	F	25.71	70.9	7.48	3.56	.917	4.39	15.09	123.31
2039-L	"	F	18.46	69.2	5.69	4.01	.742	4.20	13.63	104.73

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
1364-1360-1378-L	0.5	F	17.10	69.8	5.16	3.91	.670	2.49	8.25	63.68
1362-1368-L	"	F	15.21	70.3	4.51	3.07	.468	2.62	8.84	85.34
								2.619 ±0.433	8.741	76.547
1406-L	"	M	14.52	67.8	4.68	2.82	.410	4.99	15.48	176.95
6-1-1489-L	"	M	12.08	68.5	3.81	2.18	.264	3.89	12.33	178.44
1427-2909-L	"	M	15.26	69.8	4.61	2.56	.392	5.51	18.24	215.23
2911-2905-L	"	M	13.48	70.0	4.04	2.18	.295	5.39	17.98	247.24
1348-1372-1374-L	"	M	16.09	68.0	5.15	2.46	.397	5.72	17.87	232.52
								5.100 ±0.634	16.380	210.076
1400-1423-1429-M	"	F	20.51	72.3	5.67	.48	.100	0.046	0.17	9.58
1930-M	"	F	7.51	74.0	1.95	.35	.027	0.013	0.05	3.71
6-2-2932-M	"	F	13.97	73.4	3.71	.55	.078	0.024	0.09	4.36
2951-866-M	"	F	12.34	72.9	3.34	.54	.067	0.016	0.06	2.96
2953-2971-2963-M	"	F	21.14	72.5	5.82	.40	.086	0.018	0.07	4.50
2961-2959-2967-M	"	F	20.27	71.4	5.79	.70	.142	0.035	0.12	5.00
2039-M	"	F	7.38	72.2	2.05	.55	.041	0.026	0.09	4.72
1364-1360-1378-M	"	F	15.21	71.8	4.29	.51	.079	0.014	0.05	2.74
1362-1368-M	"	F	15.17	72.5	4.17	1.27	.194	0.047	0.17	3.70
								0.027 ±0.004	0.097	4.586
1406-M	"	M	7.65	73.1	2.06	.45	.035	0.010	0.04	2.22
6-1-1489-M	"	M	10.98	72.7	3.00	.42	.047	0.017	0.06	4.04
1427-2909-M	"	M	14.42	72.3	3.99	.29	.043	0.038	0.14	13.10
2911-2905-M	"	M	13.64	72.5	3.75	.39	.054	0.034	0.12	8.71
1358-1372-1374-M	"	M	16.04	72.5	4.41	.50	.081	0.043	0.16	8.60
								0.028 ±0.006	0.104	7.334

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
1410, 1-1 1-2-B	2.0	F	19.51	76.6	4.56	7.69	1.502	0.31	1.33	4.03
1414-1402-1421-B	"	F	18.02	76.9	4.16	7.65	1.379	0.31	1.34	4.05
1463-1467-B	"	F	12.63	76.0	3.03	9.23	1.167	0.31	1.29	3.35
489-1597-B	"	F	15.20	75.6	3.71	7.82	1.190	0.28	1.15	3.58
1599-478-B	"	F	7.61	76.3	1.80	7.42	.565	0.18	0.76	2.42
1381-1312-1387-B	"	F	16.59	76.2	3.95	7.81	1.296	0.48	2.02	6.14
1310-1301-B	"	F	10.50	76.0	2.52	7.92	.832	0.50	2.08	6.31
								0.339 ±0.042	1.424	4.269
1404-1392-B	"	M	11.34	75.6	2.77	8.45	.959	0.65	2.66	7.69
1443-B	"	M	6.06	75.4	1.49	8.51	.516	0.35	1.42	4.11
1308-1314-1326-B	"	M	16.49	75.6	4.03	9.19	1.517	0.57	2.33	6.20
								0.523 ±0.112	2.137	6.000
1410, 1-1 1-2-L	"	F	18.44	67.7	5.96	3.53	.652	6.23	19.28	176.48
1414-1402-1421-L	"	F	16.68	70.6	4.90	2.60	.435	5.02	17.09	193.07
1463-1467-L	"	F	12.56	67.0	4.15	4.02	.505	6.50	19.67	161.69
489-1597-L	"	F	14.71	69.6	4.47	2.49	.367	4.50	14.81	180.72
1599-478-L	"	F	13.26	69.5	4.05	2.36	.314	4.05	13.26	171.61
1381-1312-1387-L	"	F	21.11	70.7	6.18	3.28	.694	6.46	22.07	196.95
1310-1301-L	"	F	11.92	68.0	3.81	3.69	.440	8.56	26.78	231.97
								5.903 ±0.634	18.994	187.498
1404-1392-L	"	M	10.75	70.0	3.22	2.91	.313	8.27	27.61	284.19
1443-L	"	M	18.74	69.3	5.75	2.76	.518	2.58	8.41	93.47
1308-1314-1326-L	"	M	21.40	69.3	6.58	3.79	.812	12.4	40.33	327.17
								7.750 ±2.653	25.450	234.943

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
1410, 1-1-1-2-M	2.0	F	24.34	73.7	6.41	.46	.113	0.050	0.19	10.86
1414-1402-1421-M	"	F	25.69	75.1	6.40	.24	.062	0.020	0.08	8.33
1463-1467-M	"	F	13.77	73.9	3.60	.61	.085	0.092	0.35	15.08
489-1597-M	"	F	15.38	72.8	4.19	.38	.059	0.030	0.11	7.89
1599-478-M	"	F	7.57	72.5	2.08	.35	.027	0.017	0.06	4.85
1381-1312-1387-M	"	F	19.70	74.2	5.08	.54	.108	0.087	0.34	16.11
1310-1301-M	"	F	12.54	73.7	3.30	.36	.046	0.056	0.21	15.55
								0.050 ±0.009	0.191	11.239
1404-1392-M	"	M	18.48	73.4	4.92	1.27	.235	0.041	0.15	3.22
1443-M	"	M	9.43	71.8	2.66	1.63	.154	0.31	1.10	19.01
1308-1314-1326-M	"	M	20.90	74.2	5.39	.74	.155	0.21	0.81	28.37
								0.187 ±0.047	0.687	16.867
				1971 POOLED DATA						
176-77 178-79 186-87 3268-69-B	Control	F	24.45	77.1	5.59	7.7	1.881	<0.005	-	-
3270-71 3276-77 3278-79 3280-81-B	"	F	26.28	76.6	6.14	7.4	1.938	<0.005	-	-
3200-126 129-30 138-39 144-45-B	"	F	23.36	74.8	5.89	9.3	2.167	<0.005	-	-
253-54 255-56 267-68 273-74 277-78-B	"	F	31.14	76.2	7.40	7.7	2.409	<0.005	-	-

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
281-82										
283-84										
285-86										
287-88										
289-90-B	Control	F	34.04	76.4	8.04	7.7	2.622	<0.005	-	-
301-02										
305-06										
307-08										
309-10-B	"	F	25.25	76.8	5.85	7.2	1.814	<0.005	-	-
311-12										
313-14										
315-16										
3264-65-B	"	F	27.39	76.3	6.49	7.8	2.141	<0.005	-	-
								<0.005	-	-
279-80										
3188-89-B	"	M	12.86	73.4	3.42	7.2	0.919	<0.005	-	-
257-58										
261-62										
269-70-B	"	M	20.41	76.6	4.77	8.2	1.673	<0.005	-	-
295-96										
303-04										
3260-61										
3262-63-B	"	M	24.95	76.4	5.89	7.0	1.751	<0.005	-	-
								<0.005	-	-
176-77										
178-79										
186-87										
3268-69-L	"	F	35.38	71.2	10.20	1.2	0.422	0.040	0.14	3.33
3270-71										
3276-77										
3278-79										
3280-81-L	"	F	31.98	71.4	9.15	1.5	0.474	0.035	0.14	2.33
3200-126										
129-30										
138-39										
144-45-L	"	F	33.86	70.4	10.03	1.9	0.629	0.018	0.27	4.26

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
253-54										
255-56										
267-68										
273-74										
277-78-L	Control	F	41.79	71.0	12.13	1.4	0.556	0.021	0.07	1.50
281-82										
283-84										
285-86										
287-88										
289-90-L	"	F	47.05	72.3	13.02	0.9	0.438	0.020	0.07	2.22
301-02										
305-06										
307-08										
309-10-L	"	F	34.69	72.8	9.42	1.6	0.554	0.019	0.07	1.19
311-12										
313-14										
315-16										
3264-65-L	"	F	37.16	76.0	8.91	6.7	2.466	0.012	0.04	0.18
								0.033 ±0.003	0.114	2.144
279-80										
3188-89-L	"	M	37.16	70.9	4.01	1.6	0.221	0.11	0.03	6.88
257-58										
261-62										
269-70-L	"	M	23.06	72.3	6.38	1.6	0.355	0.067	0.25	4.19
295-96										
303-04										
3260-61										
3262-63-L	"	M	32.07	74.2	8.28	1.0	0.323	0.023	0.08	2.30
								0.067 ±0.013	0.120	4.457
176-77										
178-79										
186-87										
3268-69-M	"	F	43.09	76.8	10.01	0.5	0.220	<0.005	-	-

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
3270-71										
3276-77										
3278-79										
3280-81-M	Control	F	47.17	77.1	10.80	0.5	0.224	0.005	-	-
3200-126										
129-30										
138-39										
144-45-M	"	F	39.84	77.0	9.16	0.4	0.158	0.005	-	-
253-54										
255-56										
267-68										
273-74										
277-78-M	"	F	61.11	76.4	14.43	0.4	0.251	0.005	-	-
281-82										
283-84										
285-86										
287-88										
289-90-M	"	F	58.78	76.2	13.98	0.5	0.272	0.005	-	-
301-02										
305-06										
307-08										
309-10-M	"	F	51.97	76.0	12.47	0.4	0.229	0.005	-	-
311-12										
313-14										
315-16										
3264-65-M	"	F	49.87	76.4	11.78	0.4	0.207	0.005	-	-
								0.005	-	-
279-80										
3188-89-M	"	M	17.63	76.3	4.17	0.3	0.046	0.005	-	-
257-58										
261-62										
269-70-M	"	M	27.47	76.9	6.34	0.4	0.120	0.005	-	-
295-96										
303-04										
3260-69										
3262-63-M	"	M	45.30	76.4	10.71	0.5	0.233	0.005	-	-
								0.005	-	-

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
43-44,52-53										
54-55										
56-57										
58-59-B	0.5	F	30.06	76.6	7.02	8.1	2.421	0.095	0.43	1.17
62-63,64-65										
68-69										
74-75-B	"	F	23.26	77.3	5.29	7.2	1.675	0.14	0.62	1.94
3424-25										
3432-33										
3436-37										
3440-41-B	"	F	25.45	76.6	5.96	7.1	1.808	0.093	0.38	1.31
3442-43										
3444-45										
3450-51										
3452-53										
3454-55-B	"	F	30.54	76.6	7.13	7.9	2.411	0.10	0.43	1.27
146-47										
148-49										
154-55										
166-67										
170-71-B	"	F	33.22	76.9	7.68	7.3	2.414	0.11	0.48	1.51
225-26										
237-38										
239-40										
241-42-B	"	F	24.79	76.8	5.74	7.3	1.809	0.088	0.39	1.21
243-44										
247-48										
249-50										
251-52-B	"	F	26.88	76.4	6.34	7.4	1.978	0.10	0.42	1.35
								0.104 ±0.010	0.450	1.394
47-48,60-61										
76-77										
174-75-B	"	M	.64	76.7	6.44	7.5	2.056	0.11	0.47	1.47
3422-23										
3426-27										
3430-31										
3434-35-B	"	M	22.75	76.2	5.41	7.5	1.705	0.11	0.46	1.47

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
229-30 233-34 235-36-B	0.5	M	19.99	76.7	4.65	8.1	1.622	0.14	0.60	1.73
								0.120 ±0.018	0.510	1.557
43-44,52-53 54-55 56-57 58-59-L	"	F	35.03	72.3	9.70	1.9	0.654	1.49	5.38	78.42
62-63,64-65 68-69 74-75-L	"	F	31.02	72.5	8.53	1.7	0.533	2.02	7.35	118.82
3424-25 3432-33 3436-37 3440-41-L	"	F	29.16	71.7	8.24	1.5	0.430	1.00	3.54	66.66
3442-43 3444-45 3450-51 3452-53 3454-55-L	"	F	40.54	70.9	11.80	2.1	0.832	1.67	5.75	79.52
146-47 148-49 154-55 166-67 170-71-L	"	F	37.39	72.3	10.35	1.7	0.649	1.45	5.24	85.29
225-26 237-38 239-40 241-42-L	"	F	34.23	73.1	9.20	0.9	0.321	1.19	4.43	132.22
243-44 247-48 249-50 251-52-L	"	F	36.06	72.5	9.93	1.8	0.645	1.50	5.45	83.33
								1.474 ±0.153	5.306	92.037

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
47-48,60-61 76-77 174-75-L	0.5	M	31.30	72.0	8.77	1.3	0.391	2.30	8.21	176.92
3422-23 3426-27 3430-31 3434-35-L	"	M	26.38	71.7	7.46	1.4	0.378	2.49	8.82	177.86
229-30 233-34 235-36-L	"	M	14.31	70.5	4.22	2.0	0.279	5.13	17.39	256.50
								3.307 ±0.565	11.473	203.760
43-44,52-53 56-57 58-59-M	"	F	51.62	76.2	12.26	0.4	0.215	0.017	0.08	4.25
62-63,64-65 68-69 74-75-M	"	F	39.90	76.5	9.39	0.5	0.200	0.034	0.13	6.80
3424-25 3432-33 3436-37 3440-41-M	"	F	30.69	76.2	7.29	0.5	0.143	0.014	0.04	2.80
3442-43 3444-45 3450-51 3452-53 3454-55-M	"	F	36.10	75.8	8.75	0.6	0.203	0.032	0.12	5.33
146-47 148-49 154-55 166-67 170-71-M	"	F	45.14	77.2	10.27	0.4	0.157	0.014	0.04	3.50
225-26 237-38 239-40 241-42-M	"	F	56.76	77.0	13.03	0.4	0.228	0.012	0.04	3.00
243-44 247-48 249-50 251-52-M	"	F	40.73	76.4	9.61	0.4	0.164	0.017	0.09	4.25
								0.020 ±0.003	0.077	4.275

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
47-48,60-61 76-77 174-75-M	0.5	M	35.57	76.4	8.41	0.5	0.175	0.025	0.13	5.00
3422-23 3426-27 3430-31 3434-35-M	"	M	28.36	76.1	6.78	0.7	0.204	0.037	0.17	5.29
229-30 233-34 235-36-M	"	M	25.56	76.1	6.12	0.9	0.216	0.073	0.29	8.11
								0.045 ±0.008	0.197	6.133
5-6,7-8-B 82-83,84-85 92-93 94-95 3406-07 3412-13 3416-17-B	2.0	F	10.89	76.3	2.58	8.3	0.904	0.25	1.06	3.01
3460-61 3492-93-B	"	F	11.10	76.8	2.58	7.8	0.867	0.16	0.69	2.05
196-97 198-99 202-03 204-05-B	"	F	27.95	76.8	6.49	7.9	2.197	0.35	1.51	4.43
206-07 211-12 213-14 221-22-B	"	F	26.77	76.3	6.44	8.7	2.334	0.42	1.78	4.83
								0.328 ±0.057	1.408	3.986
33-34,188-89 190-91 192-93 200-01-B	"	M	29.45	77.1	6.75	8.1	2.382	0.37	1.61	4.57
96-97,98-99 3408-09 3456-57 3462-63 3468-69-B	"	M	35.78	77.4	6.75	8.1	2.382	0.38	1.68	4.04

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
	2.0	M						0.375 ±0.068	1.645	4.305
5-6,7-8-L	"	F	15.81	73.1	4.25	1.4	0.223	2.57	9.56	183.57
82-83,84-85										
92-93										
94-95										
3406-07										
3412-13										
3416-17-L	"	F	64.43	70.3	19.14	1.9	1.220	3.94	13.28	207.37
3460-61-L	"	F	13.94	70.5	4.11	2.5	0.346	2.07	7.02	82.80
196-97										
198-99										
202-03										
204-05-L	"	F	37.43	70.7	10.95	2.0	0.753	4.38	14.98	219.00
206-07										
211-12										
213-14										
221-22-L	"	F	38.93	73.2	10.43	2.0	0.768	4.28	15.96	214.00
								3.448 ±0.564	12.16	181.348
33-34										
188-89										
190-91										
192-93										
200-01-L	"	M	44.43	72.5	12.21	2.0	0.889	7.68	27.96	384.00
96-97,98-99										
3408-09										
3456-57										
3462-63										
3468-69-L	"	M	48.28	71.0	13.99	1.8	0.876	4.69	16.18	250.56
								6.185 ±1.172	22.07	317.280
5-6,7-8-M	"	F	21.45	77.2	4.90	0.4	0.094	0.042	0.18	10.50

Table B. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid in sample (g)	ppm dieldrin Wet	Dry	Lipid
82-83,84-85										
92-93										
94-95										
3406-07										
3412-13										
3416-17-M	2.0	F	68.34	76.5	16.09	0.3	0.197	0.067	0.30	22.33
3460-61										
3492-93-M	"	F	14.18	76.6	3.32	0.4	0.046	0.023	0.09	5.75
196-97										
198-99										
202-03										
204-05-M	"	F	64.17	77.2	14.64	0.4	0.257	0.093	0.39	23.25
206-07										
211-12										
213-14										
221-22-M	"	F	60.46	76.4	14.29	0.5	0.313	0.094	0.38	18.80
								0.064 ±0.012	0.268	16.126
33-34										
188-89										
190-91										
192-93										
200-01-M	"	M	52.83	76.4	12.46	0.3	0.166	0.044	0.17	14.67
96-97,98-99										
3408-09										
3456-57										
3462-63										
3468-69-M	"	M	50.11	76.2	11.91	0.3	0.174	0.070	0.30	23.33
								0.057 ±0.012	0.235	19.000

Table C. Dieldrin residues in brain (B), liver (L), and muscle (M) of juvenile cottontails in untreated pens (controls) and pens treated with dieldrin.

1966 EXPLORATORY DATA

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid wt in sample (g)	ppm dieldrin Wet*	Dry	Lipid
1979-B	Control	F	7.46	76.9	1.72	10.2	0.76	0.01	-	-
								0.01	-	-
1674-B	"	M	5.97	72.0	1.67	10.8	0.65	0.01	-	-
								0.01	-	-
1679-L	"	F	10.10	70.0	3.03	4.5	0.46	0.11	0.37	2.44
								0.11	0.37	2.44
1674-L	"	M	10.60	67.6	3.43	4.5	0.48	0.27	0.83	6.00
								0.27	0.83	6.00
1679-M	"	F	10.00	76.0	2.40	3.9	0.39	-	-	-
								-	-	-
1674-M	"	M	10.10	75.0	2.53	3.8	0.38	-	-	-
								-	-	-
1662-1664-B	0.5	F	10.10	76.8	2.34	9.8	0.99	0.05	0.22	0.51
1676-B	"	F	6.31	76.6	1.48	11.2	0.71	0.01	-	-
								0.030	0.11	0.26
1670-B	"	M	6.73	71.9	1.89	11.5	0.77	0.01	-	-
1683-1684-B	"	M	10.00	78.2	2.18	9.2	0.92	0.04	0.18	0.44
								0.025	0.09	0.22
1662-1664-L	"	F	10.00	72.1	2.79	4.9	0.49	0.08	0.29	1.63
1676-L	"	F	10.10	71.4	2.89	4.6	0.47	0.66	2.31	14.35
								0.370	1.30	7.99
1670-1683-L	"	M	10.10	70.1	3.02	5.4	0.55	1.00	3.34	18.52
1684-L	"	M	10.00	70.3	2.97	4.9	0.49	1.48	4.99	30.20
								1.240	4.17	24.36
1662-1664-M	"	F	10.00	77.4	2.26	4.8	0.48	0.01	-	-
1676-M	"	F	10.10	76.5	2.37	3.4	0.34	0.01	-	-
								0.01	-	-
1670-1683-M	"	M	10.00	75.1	2.49	3.1	0.31	0.01	-	-
1684-M	"	M	10.00	76.5	2.35	3.7	0.37	0.01	-	-
								0.01	-	-

Table C. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid wt in sample (g)	ppm dieldrin Wet*	Dry	Lipid
1672-B	2.0	F	4.67	75.7	1.14	10.9	0.51	0.08	0.33	0.73
								0.08	0.33	0.73
1666-1682-B	"	M	10.00	77.8	2.22	10.6	1.06	0.13	0.59	1.23
1681-B	"	M	7.57	63.3	2.78	10.4	0.79	0.20	0.54	1.92
								0.170	0.57	1.58
1672-1680-L	"	F	9.95	70.3	2.96	4.8	0.48	1.00	3.36	20.83
								1.00	3.36	20.83
1681-L	"	M	9.96	72.4	2.75	5.1	0.51	2.19	7.93	42.94
								2.19	7.93	42.94
1672-1680-M	"	F	9.96	77.2	2.27	3.8	0.38	0.01	-	-
								0.01	-	-
1666-1682-M	"	M	10.10	78.3	2.17	3.2	0.32	0.02	0.09	0.63
1681-M	"	M	9.99	75.4	2.46	5.1	0.51	0.10	0.41	1.96
								0.060	0.25	1.30

* Sensitivity = 0.01 ppm.

Table D. Dieldrin residues in brain (B), liver (L), and muscle (M) of adult cottontails in untreated pens (controls) and pens treated with dieldrin.

1966 EXPLORATORY DATA

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid wt in sample (g)	ppm dieldrin Wet*	Dry	Lipid
1547-1638-B	Control	F	10.10	74.1	2.62	10.0	0.10	0.03	0.12	0.32
1636-1640-B	"	F	10.00	75.3	2.47	9.9	0.99	0.01	-	-
								0.020	0.060	0.160
1515-1567-B	"	M	9.91	75.1	2.47	10.5	1.04	0.01	-	-
1525-1527-B	"	M	10.00	75.5	2.45	10.5	1.05	0.01	-	-
								0.01	-	-
1586-1588-L	"	F	10.00	63.0	3.70	4.9	0.49	0.25	0.68	5.10
1630-1634-L	"	F	10.00	68.0	3.20	7.8	0.78	0.06	0.19	0.77
								0.155	0.435	2.935
1515-1567-L	"	M	10.16	67.8	3.27	4.5	0.46	0.11	0.34	2.44
1525-L	"	M	10.10	64.3	3.61	4.2	0.42	0.21	0.59	5.00
								0.160	0.465	3.720
1586-1588-M	"	F	10.20	70.8	2.98	3.5	0.36	0.01	-	-
								0.01	-	-
1515-1575-M	"	M	10.10	73.3	2.70	11.6	1.17	0.01	-	-
1567-M	"	M	10.00	69.9	3.01	3.8	0.38	0.03	0.10	0.79
								0.020	0.050	0.395
1523-B	0.5	F	7.31	65.9	2.49	24.2	1.77	0.83	2.44	3.43
1541-1620-B	"	F	10.00	76.6	2.34	9.7	0.97	0.10	0.43	1.03
1614-1628-B	"	F	9.91	73.9	2.59	3.3	0.33	0.21	0.80	6.36
								0.380	1.223	3.607
1511-C-3-B	"	M	10.00	76.0	2.40	9.9	0.99	0.08	0.33	0.81
								0.08	0.33	0.81
1523-L	"	F	9.97	65.7	3.42	5.5	0.55	3.12	9.11	56.73
1541-1620-L	"	F	10.10	59.3	4.11	4.0	0.40	1.06	2.61	26.50
1614-1628-L	"	F	10.10	59.8	4.06	4.8	0.48	4.10	10.21	85.42
								2.760	7.310	56.216
1515-1567-L	"	M	10.16	67.8	3.27	4.5	0.46	0.11	0.34	2.44
								0.11	0.34	2.44
1614-M	"	F	10.00	69.8	3.02	9.6	0.96	0.05	0.17	0.52
								0.05	0.17	0.52

Table D. (continued)

Sample no.	Dieldrin treatment (lbs/acre)	Sex	Sample wet wt (g)	Percent water	Sample dry wt (g)	Percent fat	Lipid wt in sample (g)	ppm dieldrin Wet*	Dry	Lipid
1511-M	0.5	M	10.00	70.9	2.91	4.7	0.47	0.11	0.38	2.34
								0.11	0.38	2.34
1555-B	2.0	F	5.13	52.5	2.44	10.9	0.56	0.57	1.20	5.23
								0.57	1.20	5.23
1543-1656-B	"	M	10.10	78.0	2.22	8.2	0.83	0.21	0.96	2.56
C-2-B	"	M	6.45	57.9	2.72	11.5	0.74	0.38	0.90	3.30
								0.295	0.930	2.930
1555-L	"	F	10.00	61.3	3.87	5.5	0.55	15.60	40.25	283.64
								15.60	40.25	283.64
1543-1656-L	"	M	10.00	58.9	4.11	6.5	0.65	10.6	25.76	163.08
C-2-L	"	M	9.87	66.2	3.34	3.6	0.36	2.34	6.93	65.00
								6.470	16.345	114.040

* Sensitivity = 0.01 ppm.

Table E. Dieldrin residues (ppm) in the soil from 1965 through 1971. ($S_{\bar{x}}$ values involving trace amounts are based on one-half the sensitivity values.)

Control (no treatment)	Dieldrin treatment	
	0.5 lb/acre	2.0 lbs/acre
November 1965+		
<0.01	<0.01	<0.01
May 1966+		
<0.01	0.15	0.25
<0.01	0.56	0.97
<0.01	0.23	1.22
<0.01	0.23	0.62
$\bar{x}$ = <0.01	$\bar{x}$ = 0.383 ± 0.112	$\bar{x}$ = 0.765 ± 0.211
May 1968+		
<0.01	2.22	4.50
0.019	2.39	4.81
0.018	4.62	5.66
0.012	2.97	10.10
$\bar{x}$ = 0.015 ± 0.003	$\bar{x}$ = 3.050 ± 0.668	$\bar{x}$ = 6.268 ± 1.640
June 1969++		
<0.005	0.72	2.19
<0.005	2.50	2.34
<0.005	2.66	7.19
<0.005	5.00	3.28
$\bar{x}$ = <0.005	$\bar{x}$ = 2.720 ± 0.878	$\bar{x}$ = 3.750 ± 1.171
November 1969++		
<0.005	9.61	3.53
1.14	1.34	1.72
0.034	0.12	2.50
0.006	0.58	1.88
$\bar{x}$ = 0.296 ± 0.282	$\bar{x}$ = 2.913 ± 2.247	$\bar{x}$ = 2.408 ± 0.410
July 1970++		
0.007	1.78	5.31
0.005	2.34	-
<0.005	3.91	9.38
<0.005	2.34	10.0
$\bar{x}$ = 0.005 ± 0.001	$\bar{x}$ = 2.593 ± 0.459	$\bar{x}$ = 8.230 ± 1.471
April 1971++		
<0.005	3.91	5.39
<0.005	1.89	17.7
<0.005	3.36	6.34
<0.005	2.50	11.9
$\bar{x}$ = <0.005	$\bar{x}$ = 2.915 ± 0.448	$\bar{x}$ =10.333 ± 2.845

+ Sensitivity = 0.01 ppm.

++ Sensitivity = 0.005 ppm.

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