REPORT TO

MONSANTO COMPANY

TOXICITY, REPRODUCTION AND RESIDUE STUDY WITH AROCLOR 1221 IN WHITE LEGHORN CHICKENS

JUNE 20, 1972

IBT NO. J900

I. Introduction

At the request of Monsanto Company, a toxicity, reproduction and residue study with Aroclor 1221 in White Leghorn chickens was initiated. This report presents the results of the investigation conducted at Wedge's Creek Research Farm, Industrial BIO-TEST Laboratories, Inc.

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II. Summary

A toxicity, reproduction and residue study was conducted in White Leghorn chickens with Aroclor 1221. The levels were 1 (T-I), 3 (T-II) and 10 (T-III) ppm in the diet. The results of the study are as follows:

The body weights and food consumption of adult birds were normal. Three females died; one in the control group, one in the T-II group and one in the T-III group. There were no significant gross pathologic changes in any of the birds.

No abnormalities or systemic signs of toxicity attributable to the ingestion of Aroclor 1221 were observed during the investigation.

Egg production for control birds during the test period was lower than for the birds in the three test groups. In addition, the percentage of defective eggs was greater in the control group than in any of the three test groups. The hatchability of eggs in the T-III group (75.1%) was slightly lower than the hatchability in the control group (85.0%), the T-I group (85.4%) or the T-II group (83.3%).

Specific gravity and shell thickness of eggs revealed no significant differences between the control and three test groups.

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The body weight and viability data for chicks revealed no significant intergroup differences. No gross pathologic alterations were noted at the time of sacrifice.

Respectfully submitted,

INDUSTRIAL BIO-TEST LABORATORIES, INC.

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III. Procedure

A. Experimental Animals

The animals employed in the study were White Leghorn chickens. A total of 80 hens and 16 roosters was used.

B. Organization of Groups

The 96 chickens were divided into one control group (C) and three test groups (T-I, T-II and T-III). A structural outline of the experiment is presented in Table I.

TABLE I

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Outline of Experiment

Group	Number of Animals Male	Female	Dose Level (ppm)
Control	4	20	None
T-I	4	20	1.0
T-II	4	20	3.0
T-III	4	20	10.0

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C. Dosage and Feeding

All groups received the same basal feed*. Test diets were prepared weekly. The test materials were diluted with acetone before addition to the feed to assure even distribution throughout the ration. An equal amount of acetone, without test material, was added to the control feed and the feed was then blended in the same manner as the test feeds.

All animals were allowed water and their respective control or test feed ad libitum. Dosing began when the birds were 24 weeks of age and was continued for 13 weeks when hatching results were available.

D. Observations

Observations were made daily to ascertain the presence or absence of clinical signs of toxicity indicative of test material effect. All chickens were individually weighed and the group food consumption was determined weekly. As each group began laying, the eggs were collected daily and the egg weights recorded. When the egg weights were consistently between 50 and 60 grams and at least 50 percent of the hens in the group were laying, egg collection for that group was started. The time required to meet these criteria was recorded for each group.

* Purina Flock Chow, Ralston Purina Co., St. Louis, Mo.

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The eggs were collected for the following parameters:

1. Egg Production and Quality

Eggs were collected, weighed and candled for a number of seven-day periods. The total number, the individual weights of eggs collected and the total number of uncracked and unblemished eggs were recorded.

2. Hatchability

Three-fourths of all non-defective eggs were randomly selected for the seven-day collection period, then placed in an incubator maintained at 99° to 100°F, with a wet bulb reading of 85°. This procedure was followed until a minimum of 100 eggs from the control group and each test group had been set for hatching. The following were recorded.

a. Number hatched.
b. Number unhatched.
c. Viability of chicks over a 30-day period, during which period feed and water were permitted ad libitum.
d. Examination of unhatched eggs for fertility and stage of development.
e. Weight of chicks after Day 1 and Day 30.

3. Physical Characteristics of Eggs

One-fourth of the non-defective eggs and all of the defective eggs were examined to determine the following:

a. Specific gravity.
b. Thickness of shells at equatorial circumference (three measurements/egg).

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4. Residue Studies

The non-defective eggs examined for physical characteristics were quick-frozen and shipped to Monsanto Company for residue analysis (shells and frozen contents separated).

After hatching results were available, one-half of the chickens in each group were sacrificed, defeathered and subjected to a gross pathological examination. Individual samples of muscle, liver, fat and kidney from each group were collected and shipped to Monsanto Company for analysis.

The remaining chickens were fed the base diet without test material for 30 days. The eggs were collected, weighed and candled during the recovery period. Ten eggs (minimum) per group per week were quick-frozen and shipped to Monsanto Company for analysis. At the end of the recovery regimen, the remaining chickens were sacrificed and handled in the same manner as at the end of the test feeding period.

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IV. Results

A. Parental Generation

1. Body Weight Data

The average male and female body weights during the test period are shown in Table II.

The average male and female body weights during the recovery period are shown in Table III.

These data are summarized in Table IV.

The average body weight data for all test groups were considered normal when compared to the control group.

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TABLE II

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Test Diet Period Body Weight Data

		Mean Body Weight in Kilograms Week:												
Group	Sex	0	1	2	3	4	5	6	7	8	9	10	11	12
C	M	2.05	2.06	2.09	2.12	2.14	2.16	2.16	2.18	2.20	2.22	2.22	2.25	2.26
	F	1.71	1.71	1.73	1.76	1.76	1.79	1.84	1.84	1.84	1.84	1.90	1.93	1.93
T-I	M	1.92	1.97	2.00	2.06	2.04	2.07	2.06	2.09	2.09	2.13	2.15	2.15	2.18
	F	1.66	1.67	1.71	1.75	1.74	1.75	1.77	1.79	1.78	1.81	1.83	1.81	1.84
T-II	M	1.91	1.91	1.95	1.97	1.99	2.01	2.04	2.08	2.12	2.12	2.14	2.16	2.16
	F	1.61	1.61	1.64	1.66	1.66	1.70	1.72	1.75	1.76	1.76	1.79	1.80	1.79
T-III	M	2.03	2.04	2.09	2.10	2.12	2.15	2.16	2.17	2.19	2.22	2.24	2.22	2.21
	F	1.65	1.66	1.70	1.70	1.70	1.74	1.74	1.76	1.79	1.79	1.80	1.80	1.83

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TABLE III

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Recovery Period Body Weight Data

Group	Sex	Mean Body Weight in Kilograms Week: 1	2	3	4
C	M	2.26	2.23	2.24	2.25
	F	1.86	1.89	1.91	1.92
T-I	M	2.32	2.35	2.38	2.38
	F	1.78	1.78	1.79	1.79
T-II	M	1.94	1.98	2.01	2.04
	F	1.66	1.69	1.71	1.70
T-III	M	2.10	2.07	2.07	1.99
	F	1.83	1.82	1.83	1.79

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TABLE IV

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Summary of Mean Body Weight Data (kilograms)

Group	Pretest		Test Period		Sacrifice	
	Male	Female	Male	Female	Male	Female
C	2.05	1.71	2.16	1.81	2.26	1.93
T-I	1.92	1.66	2.07	1.76	2.38	1.79
T-II	1.91	1.61	2.04	1.71	2.04	1.70
T-III	2.03	1.65	2.15	1.74	1.99	1.79

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2. Food Consumption

The food consumption data are presented in Table V. Food consumption data were considered normal for all test groups when compared to the control group.

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TABLE V

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Average Food Consumption (grams/bird/day)

Week	Group C	T-1	T-II	T-III
		Test Period		
1	148.0	182.0	174.0	142.0
2	141.0	210.0	202.0	160.0
3	173.0	208.0	215.0	168.0
4	166.0	160.0	159.0	190.0
5	183.0	219.0	208.0	195.0
6	166.0	261.0	227.0	206.0
7	156.0	238.0	213.0	193.0
8	166.0	250.0	242.0	215.0
9	166.0	253.0	217.0	196.0
10	218.0	267.0	221.0	242.0
11	211.0	244.0	224.0	204.0
12	213.0	246.0	243.0	229.0
		Recovery Period		
1	110.0	200.0	225.0	227.0
2	142.0*	180.0*	190.0*	201.0*
3	128.0	140.0	202.0	210.0
4	135.0	135.0	152.0	139.0

* Incorporation of new feeding equipment.

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3. Mortality and Reactions

No abnormalities attributable to feeding Aroclor 1221 or systematic signs of toxicity were observed in any of the test groups when compared to the control group.

Mortality, chronology and diagnoses are presented in Tables VI and VII.

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TABLE VI

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Mortality, Chronology and Diagnoses

Group	Animal Number	Sex	Week Died	Clinical Diagnoses
C	440	F	9	Lymphomatosis
T-II	386	F	4	Prolapsed Rectum
T-III	392	F	1	Prolapsed Rectum

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TABLE VII

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Mortality Data

Group	Number Tested M	Number Tested F	Number Dead M	Number Dead F	Total Dead / Total Tested	Percent Dead
C	4	20	0	1	1/24	4.2
T-I	4	20	0	0	0/24	0
T-II	4	20	0	1	1/24	4.2
T-III	4	20	0	1	1/24	4.2

M = Male
F = Female

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4. Gross Pathology

Postmortem examination of the majority of birds revealed no abnormal tissue alterations.

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B. Eggs

1. Egg Production and Quality

The weekly egg production data are presented in Table VIII.

The age of the hens in all groups when collection was started was 27 weeks and 31 weeks when hatching collection ended.

The egg quality data are presented in Table IX. The percentage of defective eggs is greater in the control group than in any of the test groups.

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TABLE VIII

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Egg Production Data

Week	Control		T-I		T-II		T-III	
	Average Weight (grams)	Percent Production/Day	Average Weight (grams)	Percent Production/Day	Average Weight (grams)	Percent Production/Day	Average Weight (grams)	Percent Production/Day
				Test Period				
1	52.8	62.8	49.4	72.8	49.4	77.8	51.4	77.4
2	53.9	75.0	51.7	84.2	50.9	85.7	51.5	81.9
3	54.6	69.2	50.3	87.1	50.1	80.0	53.3	73.1
4	55.8	70.0	53.1	79.0	52.2	82.0	53.2	80.0
5	56.7	75.7	54.1	79.0	53.0	85.0	50.4	75.0
6	57.0	66.4	55.1	80.0	53.9	84.0	55.3	83.0
7	57.4	62.8	55.3	80.0	55.1	78.0	55.6	75.0
8	58.3	63.5	55.6	78.0	55.7	78.0	55.8	76.0
9	58.6	72.8	56.4	65.0	55.6	70.6	57.0	69.0
10	59.2	66.9	56.8	73.0	55.9	75.1	57.7	80.0
11	60.5	68.9	56.8	72.0	55.6	76.0	56.7	72.0
12	59.4	56.5	56.6	69.3	56.4	75.0	57.2	76.9
				Recovery Period				
1	58.6	65.4	57.0	84.2	56.4	84.7	56.2	68.0
2	58.5	68.2	56.0	58.5	54.0	55.5	55.7	60.3
3	58.5	68.2	56.3	64.2	54.7	71.4	55.5	73.0
4	59.6	69.8	56.3	60.0	55.5	77.7	56.9	63.0
5*	58.9	74.0	56.5	66.6	55.3	77.7	55.6	70.0

* 3 Days only.

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TABLE IX

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Egg Quality Data

Group	Detective Eggs Number	Detective Eggs Percent	Normal Eggs Number	Normal Eggs Percent	Total Number
C	869	53.4	760	46.6	1629
T-I	668	43.7	860	56.3	1528
T-II	460	30.1	1070	69.9	1530
T-III	439	30.5	1002	69.5	1441

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2. Hatchability

The hatchability data are presented in Table X. The percent of eggs hatched was slightly lower in group T-III when compared to the control group and the other two test groups.

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TABLE X

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Hatchability Data

Group	Eggs Set	Eggs Hatched	Percent Hatched	Eggs Unhatched	Stages of Incubation: Full Term	Mid-Term	One Week	Infertile	Percent* Infertile
C	114	97	85.0	17	10	1	2	4	3.5
T-I	110	94	85.4	16	6	3	2	5	4.5
T-II	136	114	83.3	22	4	8	5	5	3.7
T-III	129	97	75.1	32	9	10	6	7	5.4

* Percent of total set.

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3. Specific Gravity

The specific gravity data of the eggs collected and candled are presented in Table XI. Test group data were considered normal when compared to the control data.

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TABLE XI

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Specific Gravity Data

Group	Normal Eggs Number	Normal Eggs Average Specific Gravity	Defective Eggs Number	Defective Eggs Average Specific Gravity	Total Eggs Number	Total Eggs Average Specific Gravity
C	221	1.078	869	1.074	1090	1.074
T-I	220	1.081	668	1.078	888	1.080
T-II	271	1.077	460	1.071	731	1.074
T-III	248	1.081	439	1.072	687	1.076

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4. Egg Shell Thickness

The shell thickness data are presented in Table XII. The shell thickness was considered normal for all test groups when compared to the control group.

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TABLE XII

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Egg Shell Thickness (inches)

	Normal Eggs		Defective Eggs		Total Eggs	
Group	Number	Average Thickness (10^{-3})	Number	Average Thickness (10^{-3})	Number	Average Thickness (10^{-3})
C	221	0.013	869	0.012	1090	0.012
T-I	220	0.013	668	0.013	888	0.013
T-II	271	0.012	460	0.012	731	0.012
T-III	248	0.013	439	0.013	687	0.013

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C. F1 Generation

1. Mean Body Weights and Viability

The mean body weights and viability data are presented in Table XIII. A slight decrease in mean body weight was noted in all test groups on Day 1 when compared to the control group.

2. Gross Pathology

Postmortem examination of all chicks revealed no abnormal tissue alterations.

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TABLE XIII

TEST MATERIAL: Aroclor 1221

Toxicity, Reproduction and Residue Study - White Leghorn Chickens

Mean Body Weight and Viability Data

Group	Number of Chicks Day 1	Mean Body Weight Day 1 (grams)	Number of Chicks Day 30	Mean Body Weight Day 30 (grams)	Percent Viability
C	97	41.6	93	279.3	95.8
T-I	94	38.0	93	274.0	98.9
T-II	114	37.2	101	257.8	88.6
T-III	97	38.2	92	267.8	94.8

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