Dieldrin Residue Removal from the Fat of Swine*

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Chlorinated hydrocarbon contamination of swine through foraging upon treated fields has been shown by DAVICH et al. (1957) and DOBSON et al. (1971). As a result of these findings and studies by STREET (1964) who showed a reduction in dieldrin storage in tissues of rats treated with DDT plus those of WILSON and COOK (1970), who showed that phenobarbital increases the levels of many microsomal detoxifying enzymes, a further study was initiated. The purpose was to find a practical method for decontaminating swine with dieldrin in their diet.

Laboratory studies on white mice were initiated to identify materials which showed microsomal inducing properties. As a result of these tests, phenothiazine, nitroanisole and phenobarbital were selected to determine their effectiveness in increasing excretion of dieldrin from swine fat. Additionally, tests with phenobarbital with and without charcoal were initiated to determine whether charcoal enhanced the effectiveness of the phenobarbital in the operation. A second series of experiments was set up to test the effectiveness of non-oxidized phenothiazine in reducing the pesticide levels of the animals. Laboratory screening experiments indicated that non-oxidized phenothiazine was considerably more active in promoting microsomal activity in white mice than was the oxidized material.

MATERIALS AND METHODS:

Experiment #1. Twenty-five 40 pound pigs were selected from animals raised on a Purdue University hog farm. The animals had been reared on concrete and were not considered to be exposed to any pesticide. One animal was sacrificed at the time of selection and one fat sample was taken from the plate fat surrounding the kidneys and one sample from the fat along the belly line immediately beneath the skin.

Chemical analysis revealed no dieldrin accumulation. The remaining 24 animals were placed on a corn-protein supplement diet to which had been added 10 ppm actual dieldrin by weight. This ration was fed ad libitum to the animals from October 11, 1971 to December 8, 1971.

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At this time, each animal was weighed, identified with an ear tag and allotted to it's respective treatment lot. At the same time, a section of fat was taken by biopsy from the right shoulder area of each pig. Six treatment lots containing four animals each were set up and treated feed was started on December 13, 1971 (Table 1).

TABLE

Table 1. Weights of Hogs Through Treatment Period

Experiment #1.

Treatment	Ave. Weights		Ave. Weight Gained
	12/8/71	2/2/72	
Charcoal-3.4#, Phenobarbital 8.5g/100# feed	158.75[1]	241.00[1]	82.25[1]
Phenobarbital 8.5g/100# feed	154.75[1]	228.50[1]	73.75[1]
Check-No Treatment	154.00[1]	242.50[1]	88.50[1]
Charcoal-3.4#/100 # feed	139.75	220.50	80.75
Nitroanisole-135.9 g/100# feed	153.67[2]	239.00[2]	85.33[2]
Phenothiazine 45.3 g/100# feed	158.75[1]	241.00[1]	82.25[1]

[1] Ave. of 4 animals.
[2] Ave. of 3 animals.

All materials were added directly to the ground feed at the time of mixing and grinding. New material was added each time feed was ground (approximately weekly). The treated feeds were fed through January 29, 1972 and all animals were slaughtered on February 2. Weights of each pig were recorded at this time (Table 1). Two fat samples were taken at the time of slaughter one from the area below the hide on the belly and the other from the fat surrounding the kidney (plate fat). All samples were immediately frozen and held until analyzed.

Experiment #2. Twenty-four pigs, approximately 50# each, and similar in all other respects to those of experiment #1 were placed on a corn-protein supplement diet on March 25, 1972. The diet was fortified with 10 ppm by weight of actual dieldrin. Each animal was ear tagged for identification and allotted to a pen of four at this time.

The animals were fed the dieldrin enhanced diet May 1, 1972 when they were placed on a dieldrin-free diet plus varying compounds designed to eliminate the dieldrin (Table 2).

Table 2. Weight of Hogs Throughout Experiment #2.

Treatment	Ave. Weight[1]			Ave. Weight Gained[1]	
	5/1/72	5/26/72	6/21/72	5/1-5/26	5/26-6/21
Phenobarbital 8.5 g/100# feed	103.25	163.50	195.25	60.25	31.75
Phenobarbital 8.5 g & Phenothiazine 45.3 g/ 100# feed	113.25	178.50	236.25	65.25	57.75
Phenothiazine 27.6 g/ 100# feed	95.00	153.50	201.50	58.50	48.00
Phenothiazine 45.3 g/100# feed	92.25	159.50	214.50	67.25	55.00
Phenothiazine 90.6 g/100# feed	100.50	153.25	201.25	52.75	48.00
No Treatment Check	103.00	154.75	204.75	51.75	50.00

[1]Average of 4 animals.

Each animal was weighed at this time and again on May 26 when the treatments were terminated (Table 2). The animals were then finished for slaughter on June 26. At that time, samples were taken in the same manner as in Experiment #1. All samples were frozen and held until analysis.

In this experiment, the phenobarbital was added to the feed at the time of mixing and grinding. Non-oxidized phenothiazine was incorporated into gelatin-ground corn patties in the laboratory and frozen until it was fed to the animals to reduce the oxidation of the material. These patties were incorporated into the feed by thawing and crumbling and then scattering the crumbles over the feed. Initial acceptance of the materials was excellent until May 10 when the animals receiving the heaviest dosage rejected some of the pieces. Acceptance was normal again after the biscuits were completely crumbled and carefully placed on the feed surface.

CHEMICAL ANALYSIS: [a]

As mentioned above all samples were frozen and held this way until they were analyzed.

Dieldrin residues were extracted from fatty tissue samples (5 g) by homogenizing for 10 minutes with 40 ml of hexane and 20 g anhydrous sodium sulfate. The homogenate was filtered (filter cake washed with additional hexane) and the solvent removed to leave a residue of extractable lipids as previously described (2).

[a]Analyses made by Dr. R. C. Hall, Purdue Entomology Department

A MT-220 gas chromatograph equipped with a Ni^{63} electron capture detector operated at 375° C in the pulse mode was used for quantitation of dieldrin residues. Separations were performed with a 1/4" x 6" glass column containing 3% OV-1 on 80-100 mesh Chromosorb W. The column temperature was 210° C and the carrier gas (N_2) flow rate was 60 ml/minute. Results are reported on an extractable lipid basis.

RESULTS AND DISCUSSION:

Experiment #1: Phenobarbital treatments with and without charcoal were very effective in reducing the level of dieldrin in the fat of swine. Charcoal alone showed no effect upon the dieldrin level and nitroanisole, in spite of demonstrating initial activity in laboratory trials, was ineffective in reducing dieldrin levels. Phenothiazine showed some activity with dieldrin residue levels lower than the checks but higher than those of the phenobarbital treatments (Table 3).

Table 3. Dieldrin Residues in Treated Hogs.

Experiment #1.[1]

Treatment	12/8/72	2/2/72		
		Plate	Belly	Mean
Charcoal-3.4# & Phenobarbital 8.5g/100# feed	11.88[2]	0.42	1.01	0.72
Phenobarbital 8.5 g/100# feed	10.60	0.26	0.54	0.40
Check	12.10	3.09	3.28	3.19
Charcoal 3.4# / 100# feed	12.98	3.97	4.32	4.14
Nitroanisole-135.9 g/100# feed	10.65	3.05	3.23	3.14
Phenothiazine 45.3 g/100# feed	10.38	1.80	2.14	1.97

[1]Based on averages of 4 animals each.
[2]All figures expressed in ppm.

Weight gains of the treated animals were similar to those of the controls (Table 1).

Experiment #2: Results of this experiment again proved the effectiveness of phenobarbital in reducing levels of dieldrin in fattening hogs. A combination of phenobarbital and phenothiazine was no more effective in reducing the levels of dieldrin than was the phenobarbital alone. Incorporation of phenothiazine at different levels gave anomalous results. When added

at 1/2 or twice the dose originally worked out, the residues were the same as the checks. However, when it was added to the feed at a 45.3 g/100# feed rate, the resultant levels of dieldrin were lower than the checks (Table 4).

Table 4. Dieldrin Residues in Treated Hogs.

Experiment #2.[1]

Treatment	6/21/72		
	Plate	Belly	Mean
Phenobarbital 8.5 g/100# feed	0.40[2]	0.48	0.44
Phenobarbital 8.5 g & Phenothiazine 45.3 g/100# feed	0.47	0.45	0.46
Phenothiazine 22.6 g/100# feed	3.39	3.27	3.33
Phenothiazine 45.3 g/100# feed	2.55	2.64	2.60
Phenothiazine 90.6 g/100# feed	3.15	3.20	3.18
Check	3.93	3.78	3.85

[1] Based on Averages of 4 animals each.
[2] All figures Expressed in ppm.

Weight gains recorded during the treatment period show no apparent differences between treatment and check. No apparent symptoms of barbituate poisoning were expressed in this or the previous experiment and no side effects were noted. It is interesting to note, however, that weight gains of the phenobarbital treated hogs during the month following treatment were lower than those of all other lots. This may indicate a withdrawal syndrome in these animals following withdrawal of the drugs.

Based on the results of these experiments plus those reported earlier (DOBSON et al. 1971). it is evident that phenobarbital with or without addition of charcoal is effective in reducing dieldrin residues in hogs. Nitroanisole and phenothiazine are not effective at showed interesting results in both experiments and further studies may reveal the reasons for the peculiarities evidenced in the trials.

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