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RESPONSES OF PHEASANTS TO SIMULATED FIELD APPLICATIONS OF COUNTER, AN ORGANOPHOSPHATE INSECTICIDE

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Abstract: Confined hen pheasants (*Phasianus colchicus*) were exposed to simulated field applications of COUNTER 15G® Soil Insecticide (S-[[1,1-(dimethylethyl) thio]methyl] 0, 0-diethyl phosphorodithioate), a short-lived organophosphate compound, during July and August 1973. The hens exposed to COUNTER at dosage rates of both 468 g (1.03 lb) and 2,340 g (5.15 lb) of technical material per acre did not suffer from either acute or chronic organophosphate poisoning nor did they accumulate measurable residues of COUNTER or its metabolites. These findings suggested that field applications of COUNTER, in spring, at the recommended dosage rate of 454 g (1 lb) of technical material per acre would not be a serious depressant to resident pupulations of pheasants.

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COUNTER 15G® Soil Insecticide, a registered trademark of American Cyanamid Company, is an organic phosphate compound developed to control corn rootworm infestations in the United States. A granular ($0.297 \leqslant$ diam < 0.710 mm) insecticide, COUNTER contains 15 percent technical material. The recommended application rate is 227 g (8 ounces) of COUNTER 15G per 304.8 m (1,000 ft) of corn row, which is equivalent to dosage rates of 445 and 468 g (0.98 and 1.03 lb) of technical material per acre for 101.6- and 96.5-cm (40- and 38-inch) row spacings, respectively. COUNTER is applied in a 17.8-cm (7-inch) band on the soil surface over the corn row; the granular insecticide is dropped onto the soil behind the planter shoe but in front of the press wheel of the planter, and thus is pressed, but not incorporated, into the upper soil surface.

COUNTER is rapidly and extensively biodegraded in soil, plants, and animals. Its solubility in water is only 10–15 ppm. The half-life of the parent compound and of its total group of metabolites, as determined out-of-doors in sandy loam soils and indoors in silt loam soils, was about 2 weeks and 11 weeks, respectively (H. H. Nan, personal communication). COUNTER, therefore, has less environmental persistence than any organochlorine insecticide and even less persistence than many organophosphate compounds (Edwards 1972). Like other organophosphate insecticides, COUNTER is a neurotoxicant that inhibits enzyme cholinesterase activity.

As an acute poison, COUNTER is more toxic than many organophosphate and organochlorine insecticides (Hayes 1963); technical COUNTER has an oral LD_{50} of 9.0 mg/kg in female white rats and a dermal LD_{50} of 1.1 mg/kg in male albino rabbits. Acute symptoms of organophosphate poisoning generally emerge within 2 to 72 hours after exposure to the chemical. Animals that survive the acute stage of organophosphate poisoning usually recover if subsequent exposure to the chemical is prevented.

The rapid biological degradation of organophosphates generally renders them less toxic than organochlorines as chronic poisons. To illustrate, Fletcher (1972, Reps. J1777 and J1778, Industrial BIO-TEST Laboratories, Inc., Northbrook, Illinois) found, in 8-day feeding trials, that dietary median lethal concentrations (LC_{50}) of COUNTER and dieldrin were 145 ppm and 31 ppm, respectively, for 2-week-old pheasant chicks, and 185 ppm and 62 ppm,

respectively, for 2-week-old mallard (*Anas platyrhynchos*) docklings.

This investigation was designed to ascertain selected physiological responses of confined hen pheasants to simulated field applications of COUNTER 15G Soil Insecticide at 1.03 and 5.15 lb of technical material per acre.

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METHODS

The hen pheasants used in this experiment were obtained from the Max McGraw Wildlife Foundation, Dundee, Illinois, and transported to Urbana, Illinois, on 1 June 1973. These hens were members of the Foundation's laying flock and, hence, had been maintained in a laying status since early spring. Upon their arrival in Urbana, the hens were randomly compartmentalized, in groups of three each, in 16 wire-bottomed pens that measured 1.52 m (5 ft) square and 1.83 m (6 ft) high. All hens were provided a commercial game bird ration (> 19 percent protein) and water, ad libitum, during the pretreatment, treatment, and posttreatment phases of this study.

The treatment phase of the study was begun on 19 July 1973. This initiation date was selected for three reasons: (1) the confined hens had established a firm social hierarchy within each pen, which minimized social stresses, (2) the hens had adjusted to the pens and to human disturbance (including handling), which minimized those stresses associated with experimentation, and (3) most hens were approaching the end of the laying season, which placed the experimental birds on a similar physiological plateau. The hens were randomly assigned, by pens, to one of three treatments: control, 1.03 lb COUNTER (technical) per acre, and 5.15 lb COUNTER (technical) per acre. There were five replications (pens) of three hens for each treatment, or 15 hens per treatment. In addition, three hens in a single pen were subjected to a large, simulated accidental spill of COUNTER.

To simulate a field application of COUNTER, a wooden tray 76.2 cm (30 inches) square and 7.6 cm (3 inches) deep was filled with topsoil and placed in each pen. (Three samples of the topsoil yielded organochlorine residues that averaged 0.01 ppm aldrin, 0.02 ppm heptachlor epoxide, 0.10 ppm DDE, and 0.03 ppm DDT; the samples did not contain detectable residues of polychlorinated biphenyls.) These trays occupied 25 percent of the floor space of each pen. Inasmuch as nearly 60 percent of Illinois's corn crop is planted in 38-inch rows, the dosage rate for COUNTER was based on this spacing. The dosage rates for the soil trays were 0.447 g of COUNTER 15G for the normal agricultural application of 468 g (1.03 lb) of technical material per acre (hereafter termed 1-lb treatment) and 2.237 g for 5 times the normal application (hereafter termed 5-lb treatment). The granular COUNTER was applied diagonally across the soil trays in a band 17.8 cm (7 inches) wide and 60.2 cm (23.7 inches) long and was then pressed into the upper soil surface (Fig. 1). The simulated accidental spill was effected by dumping 50 g of COUNTER 15G on a soil tray to which the 1-lb dosage already

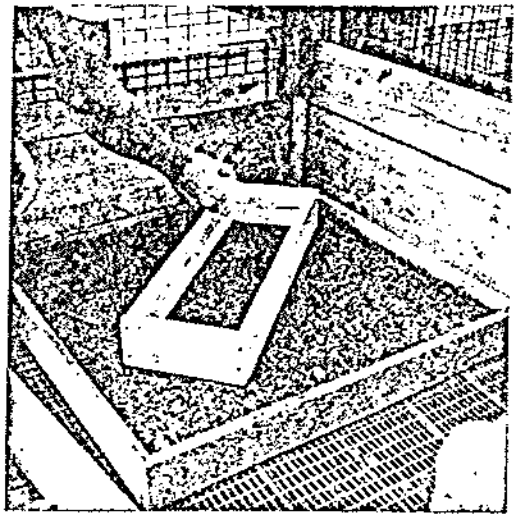

Fig. 1. Application of COUNTER to one of the 76.2- × 76.2- × 7.6-cm [30- × 30- × 3-inch] soil trays. The insecticide was placed in a 17.8-cm [7-inch] band over a hypothetical corn row to simulate normal field applications.

had been applied; the total treatment on this particular soil tray was equivalent to 51.2 kg (112.9 lb) of technical material per acre. Those pheasants designated as control birds were exposed to trays of untreated soil. The soil trays, with their appropriate treatments, were placed in the pens on 19 July and were removed 55 days later, on 12 September.

Body weights, in grams, of the hen pheasants were recorded at the onset of the treatments on 19 July, and again after 11 and 22 days of treatment, on 30 July and 10 August, respectively. The progression of molt of the 10 primary flight feathers, which are shed in a proximal (No. 1) to distal (No. 10) sequence, on the left wing was recorded for all hens on the latter date. Also, on 10 August, one hen selected randomly from each pen was sacrificed by decapitation, placed in a plastic bag, and immediately frozen for subsequent residue analysis. The remaining experimental hens were retained in their original pens until 4 October, or 77 days posttreatment. The hens then were moved, by treatment groups, into large wire-bottomed holding pens. The 10 hens in the 5-lb treatment group were released into the wild on 3 November (106 days posttreatment), and the 10 hens in both the control group and 1-lb treatment group were maintained under observation until 6 June 1974 (302 days posttreatment).

The analyses for residues of COUNTER (clinically designated as CL 92,100) and its oxidative metabolites in pheasant tissues were conducted during September 1973 (Mannel 1973, Rep. C-378. American Cyanamid Company, Princeton, New Jersey). Residue analyses were performed on selected tissues from 17 hen pheasants: control, 5 hens; 1-lb treatment, 5 hens; 5-lb treatment, 5 hens; and accidental spill, 2 hens.

RESULTS

Contact by Pheasants with COUNTER

The trays of soil, treated and untreated, which were placed in the pens on 19 July, stimulated immediate dusting activity by the hen pheasants. In fact, the hens had established dust baths in all trays within 15 minutes after the soil became available to them. This dusting behavior by the hens insured immediate and thorough dermal contact with COUNTER for all hens exposed to trays of soil treated with the insecticide.

Within two hours after the initial exposure of the hens to the soil, a rain shower thoroughly wetted both birds and soil. Although most organophosphates, including COUNTER, are relatively insoluble in water, they are more actively adsorbed by moist soil particles than by dry soil particles; the same chemical, therefore, generally has a considerably higher toxicity in moist soil than in dry soil (Edwards 1972).

Table 1. Body weight statistics for hen pheasants exposed to simulated field applications of COUNTER at dosage rates of 1 and 5 lb of technical material per acre for 22 days, 19 July–10 August 1973.

	Mean body weight or weight change (g) for specified treatment			
	Control ($n = 15$)	1 lb/acre ($n = 15$)	5 lb/acre ($n = 15$)	*F* Values[a]
Initial weight (19 July)	909 ± 20[b]	928 ± 17	916 ± 22	0.25
11-day weight (30 July)	894 ± 19	931 ± 10	903 ± 19	1.13
22-day weight (10 August)	873 ± 15	918 ± 10	899 ± 18	2.04
11-day weight change (19–30 July)	−15 ± 9	3 ± 11	−12 ± 12	0.78
22-day weight change (30 July–10 August)	−36 ± 12	−10 ± 11	−16 ± 15	1.08

[a] From analysis of variance. The reference $F_{0.05}$ was 3.22, 2 and 42 df; $P > 0.05$.
[b] Standard errors.

Irrespective of wet or dry soil conditions, however, the hens persistently frequented the soil trays, thereby permitting repeated exposure to COUNTER—through ingestion, inhalation, and, particularly, dermal contact—for all hens subjected to soil on which the insecticide had been applied.

Mortality

Neither deaths nor symptoms of organophosphate poisoning occurred among the hen pheasants exposed to COUNTER at dosage rates of either 1 or 5 lb of technical material per acre; similarly, there were no losses in the control group of hens. The observation period for the hens spanned 302 days (19 July 1973–6 June 1974) for both the 1-lb treatment group and the control group, and 106 days (19 July 1973–3 November 1973) for the 5-lb treatment group.

The three hens exposed to the large simulated accidental spill of COUNTER suffered different fates. Two hens, which exhibited symptoms of organophosphate poisoning—including an uneven gait, constriction of the pupil of the eye, and muscle spasms—within 2 hours of their initial exposure to COUNTER, died within 12 hours. The third hen showed no symptoms of COUNTER poisoning and, in fact, gained 2 g in body weight prior to 10 August, when the bird was sacrificed after 22 days of exposure.

Residues

The residues of COUNTER and its metabolites were less than 0.05 ppm, the validated level of sensitivity applicable to the analysis, in all samples of muscle, liver, skin, kidney, and fat from the hens exposed for 22 days to the insecticide at dosage rates of either 1 or 5 lb of technical material per acre.

The only one of three hens to survive the simulated spill of COUNTER failed to yield any significant organophosphate residues in either muscle or liver tissue after 22 days of exposure to the insecticide. The muscle tissue from 1 of the 2 hens that died within 12 hours of first exposure to the spill contained 0.12 ppm of COUNTER, or its metabolites; residue analyses were not performed on the other hen that died. A

composite sample of skin from the dead hen analyzed for residues and from the hen that survived exposure to the spill contained 14.4 ppm of COUNTER-related residues; a composite sample of kidney tissue from the two hens yielded a residue of 0.88 ppm.

Primary Molt and Body Weight

The progression of molt of the primary flight feathers by control and COUNTER-exposed groups of hens, as measured after 22 days of treatment, was similar. The number of the last molted primary on 10 August averaged 4.6, 5.2, and 5.2 for the 15 hens each in the control, 1-lb COUNTER, and 5-lb COUNTER group, respectively ($F = 1.19$, 1 and 42 df; $P > 0.05$).

Body weights, and changes in body weight, did not differ significantly among the control, 1-lb COUNTER, and 5-lb COUNTER groups of hens during the critical treatment phase of the study (Table 1).

DISCUSSION

Breeding hen pheasants are in their poorest physiological condition of the year during the months of July and August, which mark the cessation of egg-laying and the commencement of the postnuptial molt (Kabat et al. 1956, Anderson 1972). Both egg-laying and molt require great expenditures of energy. To illustrate, Labisky and Jackson (1969) found that hen pheasants maintained for egg production, as had been the hens in this study, suffered losses in body weight that averaged about 20 percent, or 250 g, between the onset and the termination of the laying season. It is not surprising, therefore, that Kabat et al. (1956) demonstrated that breeding hens exhibited the least physiological ability to survive applied stresses in late summer.

At the onset of the treatment phase of this study, on 19 July, the experimental hens were near the end of egg-laying and in the early stages of the postnuptial molt. The low body weights of these hens, which averaged only slightly above 900 g, suggested that their metabolic reserves were at, or near, the annual low. Thus, these hens were in that particular segment of their annual physiological cycle that potentially rendered them unusually vulnerable to the effects of extrinsic stresses—such as toxic chemicals. Yet, when exposed to simulated field applications of COUNTER, at dosage rates of 1 and 5 lb of technical material per acre, the hen pheasants neither suffered any mortality nor exhibited any noticeably unusual behavioral or physiological responses. In conclusion, the findings from this investigation suggested that field applications of COUNTER 15G Soil Insecticide, in spring, at the recommended rate of 1 lb of technical material per acre would not constitute a serious threat to resident populations of pheasants.

LITERATURE CITED

ANDERSON, W. L. 1972. Dynamics of condition parameters and organ measurements in pheasants. Illinois Nat. Hist. Surv. Bull. 30(8): 455–498.

EDWARDS, C. A. 1972. Insecticides. Pages 513–568 in C. A. I. Goring and J. W. Hamaker, eds. Organic chemicals in the soil environment. Vol. 2. Marcel Dekker, Inc., New York.

HAYES, W. J., JR. 1963. Clinical handbook on economic poisons: emergency information for treating poisoning. Rev. ed. Public Health Serv. Publ. 476. U.S. Dept. of Health, Education, and Welfare, Atlanta, Georgia. 144pp.

KABAT, C., R. K. MEYER, K. G. FLAKAS, AND R. L. HINE. 1956. Seasonal variation in stress resistance and survival in the hen pheasant. Wisconsin Conserv. Dept. Tech. Wildl. Bull. 13. 48pp.

LABISKY, R. F., AND G. L. JACKSON. 1969. Production and weights of eggs laid by yearling, 2-, and 3-year-old pheasants. J. Wildl. Manage. 33(3):718–721.

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