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Pesticide Residues in Kansas Pheasants

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Recent findings of pesticide residues in Montana waterfowl and other wildlife initiated concern over possible similar situations that might exist with Kansas wildlife. As a result of the Montana situation, the Central Flyway Technical Committee requested that other states initiate sampling programs to determine sources of contaminants in other areas of the country.

On August 25, 1982, a joint meeting between personnel from the Kansas State Board of Agriculture, the Kansas Department of Health and Environment (KDHE), and the Kansas Fish and Game Commission (KFGC) was held to discuss whether Kansas should develop a monitoring program relative to wildlife. Representatives from the three agencies were assigned to a committee to explore the topic. This paper outlines the direction of that appointed committee and the results of their findings.

MATERIALS AND METHODS

To determine whether Kansas wildlife was accumulating high pesticide levels from sources within the State, the ring-necked pheasant (*Phasianus colchicus*) was chosen for monitoring. The reasons for this selection were: (1) the species is a state resident and non-migratory; (2) the ring-necked pheasant has a very restricted range during its life and if samples were found to be contaminated such samples would have been collected close to the source of contamination and (3) the species exhibits widespread occurrence in Kansas and consequently could be collected from any desired area to be sampled.

Because no records are available at the State level to identify actual pesticide use, the State Board of Agriculture personnel developed maps based on past pest outbreak information to help identify possible high pesticide use areas. The maps were then overlapped to pinpoint areas where uses of several persistent pesticides have occurred. Three high pesticide use areas and one low use control area were identified (Fig. 1).

Three counties were randomly selected within each group of counties comprising the three high use areas and the control area and 5 pheasants were collected from each of those selected counties. All pheasant collections occurred during December, 1982, and January, 1983. Birds were identified individually by sex, age, county, and group (area in which the county sampled was located-see Fig. 1). Legal description and cover type of the collection sites were also recorded.

Birds were collected by shotgun. Upon collection, the skin and feathers, beak, feet, outerwing joint, and entire gastro-intestinal tract were removed. If birds were shot in a manner resulting in intestinal or gut spillage into the body cavity, the specimens were discarded and replaced with a subsequent collection. Each specimen was individually wrapped in aluminum foil. An identifying tag was placed inside a sealed plastic bag along with the wrapped specimen. Similar tags were attached to the outside of the bag. Upon field preparation each bird was immediately frozen before transport to the laboratory for further preparation.

Upon transfer to the laboratory, each bird was ground in a cast aluminum grinder to produce a homogenate. Birds from a single county were then combined for a composite analysis to reduce analytical costs. Pesticide analyses were performed at the Food and Drug Administration (FDA) laboratory in Kansas City, Missouri. Analyses followed the procedures of FDA "Market Basket Survey" for domestic food and included all priority pollutants. The Kansas Fish and Game Commission and Kansas Department of Health and Environment requested that, if needed, additional procedures be used to analyze for the following compounds: endrin, heptachlor, toxaphene, dieldrin, aldrin, methoxychlor, chlordane, ethyl parathion, methyl parathion, disulfoton, carbofuran, carbaryl, and polychlorinated-biphenyls.

RESULTS AND DISCUSSION

Fifteen birds were collected from Group 1 counties (6 adults, 8 juveniles, and 1 of unknown age), 11 from Group 2 counties (all juveniles), 15 from Group 3 counties (4 adults, 3 juveniles, and 8 of unknown age), and 15 from control counties of Group 4 (2 adults, 7 juveniles, and 6 of unknown age). Five of the twelve composite samples contained measurable quantities of pesticides or derivatives (Table 1). Samples from Kearny and Greeley Counties contained no detectable residues. Composites from Wichita, Butler, Sedgwick, and Washington Counties contained 0.005 ppm of hexachlorobenzene. Pentachlorobenzene was also found in the Washington County sample.

Pheasant populations in the sampled areas apparently are not accumulating large quantities of pesticides. Several factors may contribute to this condition: (1) there has been a lessened use of organochlorine pesticides because of governmental restrictions and an increased substitution of organophosphate pesticides; (2) there may be a restricted use by pheasants of areas of application during or immediately following application periods; (3) pesticides may quickly become unavailable to pheasants via food items because of degradation by way of photo-decomposition of surface residues, soil particle binding, microbial breakdown, leaching, and runoff; (4) the pheasants life span is relatively short (McAtee 1945) and subsequently the opportunity for bioaccumulation is lessened; (5) birds exposed to pesticides (i.e. ethyl parathion) may suffer heavy mortalities and are consequently not represented in the field samples; (6) our sample was too limited to detect contaminated birds which could exist around certain widely scattered fields; or (7) our sample may underrepresent bioaccumulation occurring with adults that may eat contaminated grains during spring (prehatch). While the situation hypothesized in item 5 may occur, its widespread occurrence is doubtful because of high pheasant populations occurring in the past several years in the State of Kansas (Rodgers 1983).

As young pheasants are highly insectivorous (Trippensee 1948), areas utilized by broods for a food source would be areas of insect abundance. If a crop field was sprayed and direct mortality of birds did not occur, the removal of insect food sources may cause young birds to move to an area of greater insect availability.

The use of dieldrin and heptachlor was banned in Kansas in 1975 and 1976, respectively. Consequently, low levels of these contaminants could be expected in current pheasant populations. Agricultural uses of aldrin and chlordane have also been banned. Endrin uses on alfalfa, corn, and sorghum were cancelled in 1979. Endrin, however, can still be applied on wheat for army and pale cutworm control. Tillage of wheat stubble before winter may eliminate much pheasant use of these fields and hence reduce potential endrin contamination. However, tillage also destroys usable cover for upland game birds (Rodgers and Wooley 1983).

Substitution of readily biodegradable pesticides for more persistent compounds should be encouraged. Research should focus on application rates, timing of application, and prudent use of chemicals to lessen accute impacts on bird populations.

The low levels of contamination found in Kansas pheasants may apply to other resident upland bird populations which are closely associated with crop fields (e.g. northern bobwhite, Colinus virginianus). Because greater prairie chickens (Tympanuchus cupido) utilize grasslands to a greater extent than pheasants, they may encounter pesticide residues less often.

It is doubtful that wintering or transient waterfowl utilizing grain stubble fields in Kansas are contaminated from that source, as the same fields are utilized by pheasant populations consuming grain in the fall and winter. However, the possibility that aquatic environments within the borders of Kansas contribute to the waterfowl contamination potential cannot be ruled out by the results of this study

Pesticide use varies annually due to the availability of new compounds, regulation changes, varying weather patterns, and changes in the nature and severity of pest outbreaks. A one-time sampling

Table 1. Results, by county, of pheasant contaminant analysis.

County	Contaminants and quantities
Group 1	
Kearny	no residues
Wichita	0.005 ppm hexachlorobenzene (HCB)
Greeley	no residues
Group 2	
Butler	0.005 ppm HCB
Sedgwick	0.005 ppm HCB
Sumner	Trace HCB
Group 3	
Marshall	0.006 ppm pentachlorobenzene
Riley	Trace HCB
Washington	Trace pentachlorobenzene
	0.005 ppm HCB
	Trace Heptachlor Epoxide
	Trace Dieldrin
Group 4	
Rooks	Trace HCB
Phillips	Trace HCB
Smith	Trace HCB

effort is not sufficient to ensure long term safety; consequently, monitoring of pesticide levels in upland birds should be performed on a repetitive basis (every 2 to 3 years).

Two separate problems are involved in a study such as this: (1) effects of pesticides on pheasant population and physiology and (2) human health hazards from eating pesticide-contaminated game. Because the study did not include separate organ analyses (such as brain tissue) no conclusions can be drawn related to problem 1. In addition, winter collections of pheasants are restricted to sampling survivors in a population, therefore, acute mortality cannot be assessed. Organophosphate effects on birds must be analyzed for by enzyme tests on brain tissue as residues do not accumulate. The fact that such compounds did not appear in our analyses is not surprising. While FDA tolerances for pesticides in meat and poultry are based on lipid concentrations, this study did not separate lipid and muscle analyses. Consequently, the results of this study should be viewed as a preliminary investigation of organochlorine concentrations in whole bodies of pheasants in winter.

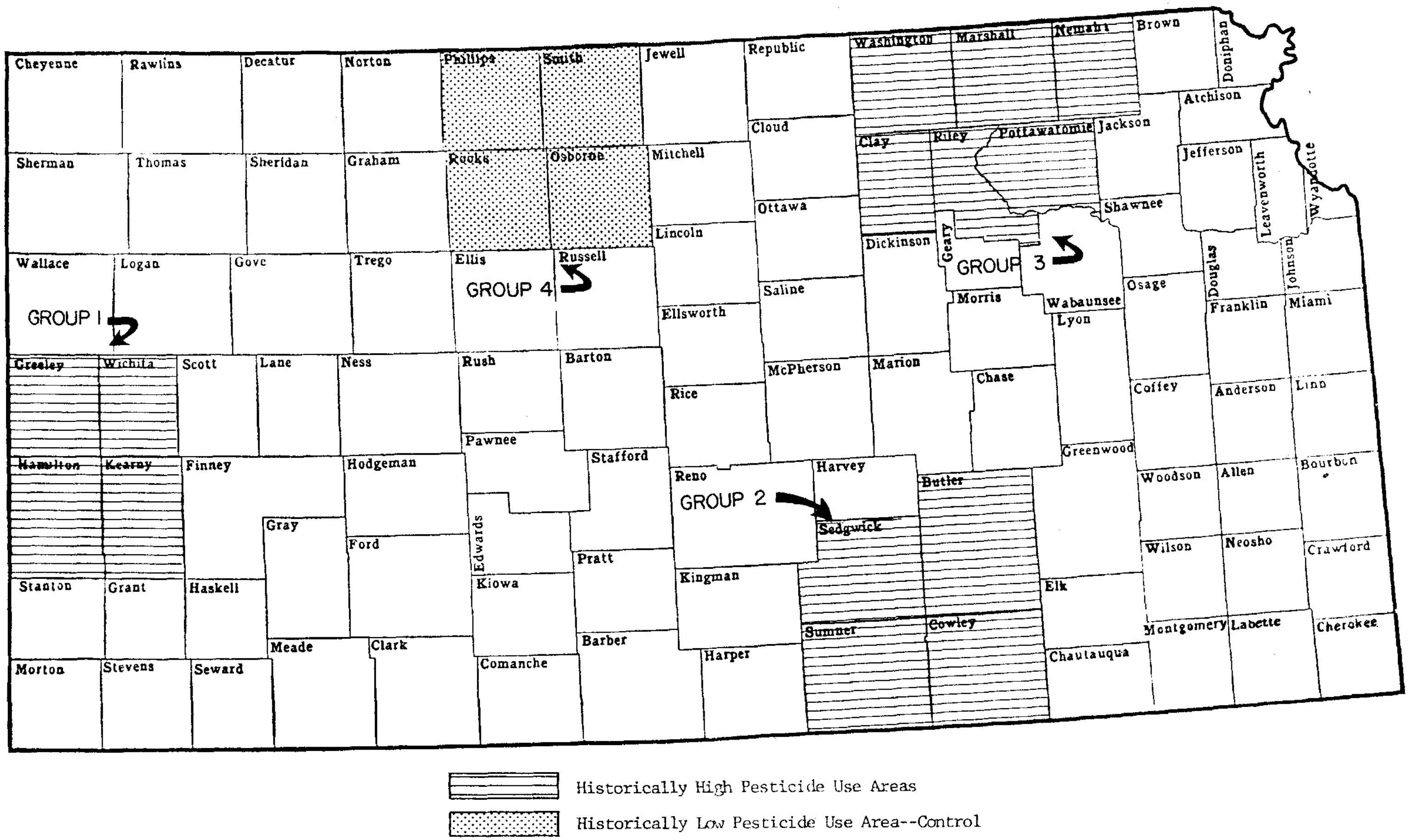

Figure 1. Areas of Kansas used to sample ring-necked pheasants for pesticide analyses.

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