

The California Department of Fish and Game has a specially trained pesticide investigation team which checks suspected pesticide kills of fish or wildlife. The cost of investigations and necessary chemical analyses are borne as a Federal Aid project. Most States would not require such an elaborate system.

A workable pesticide alarm system could be set up somewhat as follows. At least one person in the State game and fish department could be assigned the responsibility of pesticide coordinator. He would keep abreast of the latest information on pesticide-wildlife problems in neighboring States and the current literature. He would give necessary instructions to field personnel and make appropriate news releases to the public.

The decision as to when a reported fish or wildlife mortality should be investigated as a possible pesticide incident would be his, and he would head the investigation. He would exchange pesticide information with coordinators in neighboring States and the Regional Office of the Bureau of Sport Fisheries and Wildlife. Field personnel of the game and fish agency and other conservationists such as Audubonites, Izaak Walton Leaguers, and Wildlife Federationists could function as the grass roots of the reporting system.

The Bureau of Sport Fisheries and Wildlife can provide limited assistance for investigating significant fish or wildlife kills where pesticides are suspected. Establishment of an effective reporting system throughout the southeast could justify a cooperatively financed pesticide investigation team similar to that of the Southeastern Wildlife Disease Study or the Fish Parasite and Disease Study. This could also be an answer to the problem of obtaining fast and reliable chemical analysis.

I believe that an appropriate system for investigating pesticide kills and exchanging information of this type merits serious consideration by concerned conservation agencies. The early establishment of such a system could have a profound effect on the future of wildlife conservation in this country.

#### LITERATURE CITED

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## **SOME EMERGENCY DISEASE ASPECTS OF DEER MANAGEMENT IN THE SOUTHEAST**

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The Southeastern Cooperative Wildlife Disease Study (SCWDS) was established July 1, 1957, at which time deer populations throughout the Southeast had commenced to expand at an unprecedented rate. This afforded considerable aesthetic pleasure for the general public, increased recreational opportunities for countless thousands of sportsmen, and significant economic returns to local communities and counties of all southeastern states. With this influx of a new, multi-million dollar, renewable natural resource, livestock producers and public health officials became

<sup>1</sup> This is the first regional diagnostic and research service established in the United States for the specific purpose of investigating diseases of game animals. The project is supported by the Southeastern Association of Game and Fish Commissioners and the Bureau of Sport Fisheries and Wildlife of the United States Department of the Interior. Participating states include: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia.

rightfully concerned with the disease-carrying potentials of these recently acquired inhabitants of farm premises.

One of the earliest obligations of the SCWDS therefore involved investigating disease interrelationships existing between southeastern big game animals and domestic livestock. Four of the more controversial disease entities are considered in this presentation.

BRUCELLOSIS, a highly infectious bacterial disease of both cattle and man (Undulant Fever or Bang's Disease), was the first item causing major anxiety. While dairymen and beef producers were suffering heavy financial losses as affiliates of the National Brucellosis Eradication Program, practicing and regulatory veterinarians became more and more apprehensive of the newly introduced cloven-hoofed animals. In fact, most veterinary textbooks of that time listed deer as likely carriers of brucellosis, but substantial data certainly were not available to justify blanket condemnation of the species.

*Investigation directed toward alleviating this looming controversy constituted the first SCWDS program pertaining to game animals as carriers of diseases affecting domestic livestock.* Over a period of three years, serum specimens were collected from more than 7,000 deer representative of practically all types of habitat in the Southeast. Concomitant with this regional survey, transmission studies were conducted in collaboration with the Alabama Cooperative Wildlife Research Unit at Auburn University. Shortly after these southeastern projects were initiated, workers in other regions also became interested in the possibilities of brucellosis among wild deer, and similar surveillance projects were started.

Without exception, the end results of these independent studies demonstrated previous conjecture to be incorrect, as deer were found to be inconsequential as carriers of brucellosis. Today, these big game animals are not considered a complicating factor for the National Brucellosis Eradication Program conducted under auspices of the Animal Health Division of the Agricultural Research Service (ARS), U. S. Department of Agriculture (USDA). Time, monies, and effort thereby spent represent a vital contribution to a major segment of the nation's big game animal resources and the livestock industry.

ANAPLASMOSIS, an extremely costly rickettsia-like disease of cattle, was the next infectious entity that demanded immediate attention. Within numerous localities throughout a majority of states in the Southeast, this blood malady was inflicting serious losses upon the livestock industry. Once again, cattlemen and veterinarians rightfully demanded valid information on the reservoir aspects of white-tailed deer. The finger of suspicion pointed strongly toward these animals, and although conclusive evidence was not available, a "better to be safe than sorry" consensus gained prevalence. In one specific instance, through court action a local Cattlemen's Association requested liquidation of wild deer from an entire county. The resolution was carefully considered by the Grand Jury, but judgment was withheld pending results of research which fortunately the SCWDS was in position to support.

The regional anaplasmosis study was in collaboration with the Animal Disease Department of the Georgia Coastal Plain Experiment Station at Tifton, and involved eight State Game and Fish Agencies. Blood (500 ml.) was collected from each of 270 wild deer with subsequent injection of washed red blood cells into 32 splenectomized calves. Calves were challenged with red blood cells from a known bovine carrier 75 days later. Adequate control calves also were maintained and challenged. This was the most extensive and elaborately designed deer/cattle anaplasmosis study thus far on record. Workers in other regions of the country also became interested in this investigation, and similar transmission studies were inaugurated.

This two-year research program demonstrated deer to be unlikely carriers of anaplasmosis even in endemic areas. Today, these big game animals are considered to be of little consequence as perpetuators of the disease and should not afford a complicating factor whenever a national anaplasmosis eradication program might be contemplated by the Animal Health Division (ARS, USDA). This investment

subsequently represents another landmark in clarification of pertinent questions vital to the nation's game animal resources and livestock economy.

PIROPLASMOSIS, the dreaded protozoan disease of yesteryear, poses an ever-impending threat to the cattle industry of all southern states. Although the essential tick vectors (*Boophilus* spp.) for this highly infectious blood pathogen have been eradicated from the continental United States, reintroduction from outside still is of major concern for both game animal and livestock interests.

The last significant occurrence of fever ticks in this country was in Florida during the late 30's and early 40's, at which time thousands of deer were slaughtered as part of eradication efforts. A storm of controversy followed the deer depopulation program, for the reservoir status of these animals had not been clearly defined. It is of interest to note, however, of 715 deer shot and examined in Orange and Osceola Counties, 122 were infested with fever ticks. The last "ticky deer" from that area was reported in March, 1939, but annihilation of deer continued through December, 1939. When the eradication program reached South Florida, infested deer again were encountered. Because of the apparent success of the deer reduction program in Orange and Osceola Counties, legislation was approved for deer depopulation throughout Collier and Hendry Counties, despite violent controversy. It was not until December, 1950, that the U. S. Tick Eradication Program was considered complete. Expanding deer herds throughout the Southeast nevertheless constituted continual anxiety for cattle producers and game officials alike, with definitive research desperately needed.

Extensive studies involving deer/cattle/fever tick relationships were initiated July 1, 1964, on St. Croix of the U. S. Virgin Islands. The objective was to determine whether or not fever ticks (*Boophilus microplus*) could be exterminated through dipping of cattle only without molesting deer. Cattle/deer pasture facilities, holding pens, dipping vats, etc. were constructed for this investigation. Wild deer also were collected from critical locations throughout the tick-infested island and carefully examined. This program was under the supervision of a full-time veterinarian with a staff of three lay assistants. After three years of gruelling work, the project was completed June 15, 1967, with the conclusion phase supervised in part by Animal Health Division (USDA) and Bureau of Sport Fisheries and Wildlife (USDI) officials.

Results of this island study were not so clearly defined as had been the case with the brucellosis and anaplasmosis research programs, nor were all data obtained favorable for white-tailed deer. Although the findings indicated that eradication of fever ticks can be accomplished through dipping of cattle which are in close proximity to wild deer, it also was disclosed that *B. microplus* can be maintained within deer herds totally isolated from cattle. A "gray area" therefore was created, so that in the event of reintroduction of *B. microplus* onto the continental United States, environmental circumstances must be individually evaluated before policy is established for tick eradication. Information gained nevertheless will be of much value should such a catastrophe occur, with immeasurable contributions having been made toward preventing another regrettable clash of interests between cattlemen and sportsmen throughout the South.

The most direct approach toward circumventing a major fever tick crisis is through preventive medicine. It is for this reason that State Game and Fish Agencies are working in cooperation with the Animal Health Division (ARS, USDA) in an "around the clock" vigilance program, whereby ticks are routinely collected from deer and other wild animal species. The SCWDS serves as a "clearing house" for specimens, and identifications are made by the Parasite Reference Center of the Animal Health Division (ARS, USDA). Through early detection, future problems associated with fever tick introduction should be greatly minimized. This program affords an excellent example of wildlife and domestic livestock interests working together for mutual benefits directly applicable to the national welfare.

FOOT and MOUTH DISEASE (FMD), the scourge of cloven-hoofed animals of the Old World, poses the number one threat to wildlife and domestic livestock in the United States today. Caused by one of the smallest viruses known to man, the awesome consequences of *accidental* or *purposeful* introduction of FMD constitute a

matter of grave public concern. Although the last outbreak of this highly contagious and devastating disease entity in this country occurred in 1929, rapid air transportation, accelerated military/tourist/business travel, and increased importation of meat and by-products thereof, etc., greatly potentiate an unprecedented epizootic which could dwarf, in comparison, the catastrophe recently experienced on the British Isles.

In contrast to the diseases previously discussed, research involving susceptibility of wild deer to FMD would hardly be justified. The status of all cloven-hoofed animals as reservoirs of this highly contagious entity already has been established.

The last account of FMD infection among Cervidae in this country was in 1924, at which time eradication of the disease necessitated slaughter of more than 22,000 deer, of which active or healed lesions were observed on 2,279 animals. Although much controversy resulted from this drastic action, it was essential and in the interest of the nation's welfare. Early detection therefore is the only solution for minimizing the devastating aftermath of FMD introduction, which must be followed by a well-organized program for immediate containment and eradication of the disease. The future of the nation's multi-billion dollar livestock and big game animal investments depends upon maximum cooperation between livestock and wildlife interests.

It is for these reasons that Game and Fish Agencies throughout the southeastern United States joined forces with the Animal Health Division (ARS, USDA) in preparation for the ever-increasing likelihood of FMD introduction into this country. This vital merger of resources was initiated July 19-21, 1967, when the Animal Health Division (ARS, USDA) sponsored a Foreign and Emergency Disease Surveillance Training Program in response to a resolution adopted by the Southeastern Association of Game and Fish Commissioners. The conference was coordinated by the Southeastern Cooperative Wildlife Disease Study of the University of Georgia's School of Veterinary Medicine and held at the Georgia Center for Continuing Education. Game Officials, Biologists, and Law Enforcement personnel from fifteen states participated in this meeting. States represented were Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, and West Virginia. The program was conducted by many internationally recognized specialists from the U. S. Departments of Agriculture and The Interior.

As follow-up of the regional program, all southeastern states have completed or are in the process of planning similar training sessions at the state level. These conferences encompass the full complement of technical and law enforcement personnel, which essentially adds from 150 to 250 trained people per state. These men are well versed on the full ramifications of foreign disease introduction and the necessity for immediate reporting of any suspicious case involving wildlife or domestic animals. Conservation Officials and Game Biologists subsequently have direct communications with Animal Health Division officials (ARS, USDA) and excellent liaison with their respective State Veterinarians and Diagnostic Laboratories.

As a result of these cooperative efforts, southeastern wildlife interests now are in position to make paramount contributions in the eventuality of foreign disease introduction. The major regret today is that these cooperative activities have been restricted thus far to the Southeast. It is hoped, however, that within the near future similar resolutions will be adopted by other Game and Fish Associations, with wildlife and domestic animal interests ultimately combining forces on a national front. This will be invaluable insurance toward the preservation of countless thousands of big game animals, millions of domestic livestock, and billions of dollars. Such investment today will pay unprecedented dividends tomorrow.

#### ACKNOWLEDGEMENTS

The author extends his sincere thanks for the invaluable contributions made by countless numbers of individuals who have made this report feasible. It is his profound hope that the fruits of these cooperative endeavors will prove worthy of

the unparalleled interest and efforts shown by sportsmen, game officials, biologists, law enforcement personnel, and many others. Without such support an account of this kind would not have been possible.

## THE EFFECTS OF ARASAN-ENDRIN TREATED PINE SEED ON BOBWHITE QUAIL, GRAY SQUIRREL AND TURKEY<sup>1</sup>

By William J. Hamrick

Arasan-endrin<sup>2</sup> coated pine seed has been recommended to repel birds and rodents for direct seeding to establish a stand of forest trees. The recommended rate of treatment per 100 pounds of seed was 10 pounds of Arasan-75 and two pounds of endrin 50W (one per cent effective endrin), with Flintkote's C-13-HPC asphalt emulsion or Dow Latex 512-R recommended as a sticker to bond the repellents to the seed. Aluminum powder could be added at the rate of one cup per 100 pounds of seed (Mann and Derr, 1961). Recommended rates of seeding were one pound of slash or loblolly seed per acre or three pounds of longleaf seed per acre (Martin, 1959). Seeding dates, as recommended by Martin (1959), were late February or early March in central and North Alabama and December, January or February in South Alabama.

Kerr (1959) stated that about 75,000 acres were direct-seeded in the south in 1959. There has been some indication that animal depredation on treated seed remains a problem, at least under certain conditions. The use of treated seed as food by wildlife, along with the acreage involved and the known toxic properties of endrin, has caused some concern as to the possible adverse effects of this technique on game species.

The objectives of this study were to determine the toxicity and repellent qualities of Arasan-endrin treated pine seed, as used for forest reseeded, to wildlife. Specific objectives were to determine:

1. The lethal dosage of such treated seed for bobwhite quail (*Colinus virginianus* L.), gray squirrels (*Sciurus carolinensis* L.) and turkeys (*Meleagris gallapavo* L.).
2. The repellent qualities of treated pine seed in respect to the above wildlife species.

During the study some information was obtained on repellent qualities concerning cotton rats (*Sigmodon hispidus* Say and Ord) and chipmunk (*Tamias striatus* L.).

### PROCEDURE AND RESULTS

The Arasan-endrin treated seed used in this study were obtained from a commercial seed supplier. The treatment was that recommended and used for reseeded to establish a stand of forest trees. The treatment was two per cent Endrin 50W, eight per cent Arasan 42-S and aluminum coloring. Arasan 42-S, an aqueous liquid containing four pounds of thiram (Arasan) per gallon is easy to apply, is as effective in protecting pine seed as the older formulations and provides a more durable coating (Derr, 1963a). Derr (1963b) also stated: "Application of two gallons per 100 pounds of seed (dry-weight basis) provides approximately the same amount

<sup>1</sup>A contribution of the Alabama Cooperative Wildlife Research Unit, Auburn University, the Alabama Department of Conservation, the U. S. Bureau of Sport Fisheries and Wildlife and the Wildlife Management Institute, cooperating. Presented at Technical Game Sessions of the 22nd Annual Conference of Southeastern Association of Game and Fish Commissioners, October 1968.

<sup>2</sup>Arasan or thiram is tetramethyl thiuram disulfide. Endrin is 1,2,3,4,10,10 hexachloro-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-1, 4, 5, 8-endo-endo-dimethanonaphthalene.