10-11-88

DATA EVALUATION RECORD PAGE 1 OF

CASE: GS0103 PHORATE FRSTR

CONT-CAT: 01 GUIDELINES: 71-5

MRID: 40165901

Dingledine, J.; Jaber, M. (1987) An Evaluation of the Effects of Thimet 20-G upon Terrestrial Wildlife Species under Actual Use Conditions: Laboratory Project ID: 130-139. Unpublished study prepred by Wildlife International, Ltd. 494 p.

REVIEW RESULTS:

VALID ✓ INVALID ____ INCOMPLETE ____

GUIDELINE: SATISFIED ____ PARTIALLY SATISFIED ✓ NOT SATISFIED ____

DIRECT RVW TIME = 12hr START DATE: 6/1/88 END DATE: 6/30/88

REVIEWED BY: Ann Stavola

TITLE: Aquatic Biologist

ORG: HED/EEB

LOC/TEL: CM2 for D 557-1354

SIGNATURE: Ann Stavola DATE: 7/11/88

APPROVED BY:

TITLE:

ORG:

LOC/TEL:

SIGNATURE: Sandra J. Olson DATE: 10/11/88

1. Chemical: Phorate

2. Test Material: Thimet 20G, 20% ai

3. Study/Action Type: Terrestrial Field Study (Level I)

4. Study ID: MRID 40165906 Dinqledine, J., Jaber, M. (1987) - An Evaluation of the Effects of Thimet 20G upon Terrestrial Wildlife Species under Actual Use Conditions - Laboratory Project No.: 130-139. Unpublished study prepared by Wildlife International, Ltd.

5. Reviewed By: Ann Stavola
Aquatic Biologist
HED/EEB
Signature: Ann Stavola
Date: 7/25/88

6. Approved By: Douglas Urban
Supervisory Biologist
HED/EEB
Signature: Douglas J. Urban
Date: 10/11/88

7. Conclusions:

The study is scientifically sound and demonstrates that the application of Thimet 20G to corn can kill birds and mammals. The aerial application appeared to be more hazardous than the at-planting and cultivation methods due to the greater availability of the granules. The study does not complete the data requirement for a terrestrial field study as it does not permit a quantification of mortality or an estimate of avian and mammalian population effects. A level II study is needed.

8. Background:

Terrestrial field testing was required under 71-5 of the Generic Data Requirements for phorate in 1984. The data requirement stated that full field studies with population monitoring were needed.

In meetings between EEB and American Cyanamid, it was agreed that the study should be done in corn fields as corn is the major use of phorate.

Representatives of EEB visited the test sites in Maryland on July 17, 1985 with personnel from American Cyanamid (AC) and Wildlife International Limited (WIL).

American Cyanamid also manufactures terbufos, another highly toxic granular organophosphate insecticide. An avian field study for terbufos was conducted in Talbot County, Maryland in 1984. The protocols for both studies are basically identical, and some fields were test sites in both studies.

10. Discussion of Individual Studies:

The phorate study is actually comprised of three separate studies, one for each of the approved methods of application: at-planting, cultivation, and aerial broadcast over the corn plants. Each phase of the study uses the same field methods to monitor bird activity on the fields and to measure mortality.

Residue analyses of carcasses were done by American Cyanamid. In a meeting on April 30, 1985 between EEB and American Cyanamid, it was agreed that the level of detection of phorate residues would be whole-body residues associated with the oral administration of a laboratory-derived LD_{20} in bobwhite quail. They stated that with this degree of sensitivity, ChE measurements would not be necessary.

11. Material and Methods:

a. Test Material - Thimet 20G, a granular formulation of phorate, an organophosphorous insecticide-nematicide.

b. Study Sites - The study was done on corn fields in Talbot County, Maryland about 10 miles southwest of Easton on the eastern shore of the state. The county is in the Atlantic Coastal Plain, and almost 90 percent of its area is bounded by tidal water. Elevation is no greater than 25 feet above sea level, and the topography is relatively flat. The area is well-drained by tidal creeks and rivers, and surface water in the nearly flat areas runs off through man-made ditches.

The climate is humid, and the average annual temperature is 56 °F. The average growing season is 198 days, and annual precipitation is 44.65 inches.

Daily maximum and minimum temperatures, precipitation, cloud cover, and wind speed data were collected for this study at the U.S. Weather Service reading station at Royal Oak, Maryland, which is 5 miles from the study sites.

Soils in this area are the Keyport - Mattapox Association and the Elkton, Othello, Barclay Association which are basically a mixture of clayey mixed mesic soils and fine-silty mixed mesic soils.

The vegetation types in the edge habitats around the fields consisted of mature woodlands [Loblolly pines, mixed hardwoods (oaks, red maple, hickory, sweet gum)], hedgerows [young hardwoods, (sweet gum, red maple, eastern red cedar), woody shrubs], grassy ditches and single lines of trees.

c. Experimental Design - There were 8 study fields, none of which served as control sites. Distances between fields ranged from 30 feet to 6 miles. The sites were:

Bushy Heath (BH)*	26.8 A
Camper (CA)*	28.8 A
Churct Neck II (CNII)	13.9 A
Church Neck III (CNIII)	16.7 A
Ferry Neck I (FNI)*	25.0 A
Ferry Neck II (FNII)*	20.1 A
Bellevue (BE)	20.5 A
Solitude (SL)	8.9 A

*Also used in the terbufos study.

A portion of Camper field (11A) was planted with soybeans, and therefore, was not part of the study. Corn fields immediately adjacent to test fields were also treated with Thimet 20G. Because the label allows only 2 applications per field per season, all fields were treated at-planting, but only 4 fields at each of the other times.

The applications were made on the following schedule.

1) Planting Time Application - The nominal rate of application was 6.5 lb Thimet 20G/A (6 oz/1000 ft of row). A John Deere Model 7000 Max-emerge planter was used to plant the corn and apply the insecticide. The corn rows were 30 inches apart. The pesticide granules were applied in a 7-inch band over the row, behind the double disk furrow opener and in front of the soil firming wheels. No other method of soil incorporation was used. Following planting, all fields but SL were treated with 1.98 lb ai cyanazine and 0.998 lb ai atrazine/A. SL was treated with 1.5 lb ai atrazine/A. Planting on all fields began May 6, 1985 and was completed on May 10, 1985.

2) Cultivation Application - The applications were done with a Gandy 901 granular applicator at a nominal rate of 6.5 lb Thimet 20G/A. The granules were applied in a 7-inch band directly over the corn plants just ahead of the cultivator shovels. The

corn plants were 18 inches high. Cultivation on 4 fields began on June 11, 1985 and was completed on June 15, 1985. Only 4 fields were treated with this method: Bushy Heath, Solitude, Bellevue, and Church Neck III.

3) Aerial Application - The applications were done with commercial aerial application equipment at a nominal rate of 5 lb Thimet 20 G/A. The Applicator used a Cessna Ag Husky flying at a height of 30 feet above the crop and a swath width of 45 feet. The corn was 6.5 feet to 7 feet high with tassels. The applications to 4 fields (Camper, Church Neck II, Ferry Neck I, and Ferry Neck II) occurred on July 18, 1985. The equipment was calibrated prior to use. The actual amount applied exceeded the nominal rate by 25 percent.

d. Avian Surveys - Surveys of birds around each field were made prior to and after each application. A single observer walked a transect that ran along the field edge and completely encircled the field. Points along the transects were marked by lettered stakes to aid in orientation. Data were recorded on prepared sketched maps of the fields and bird activities, species, location, and habitat recorded. Birds 100 ft or more from the edges of fields and birds flying over the field at 100 ft or more were not recorded. Surveys were not done when there was heavy rain. One survey required 1 hour to complete. Surveys began close to sunrise and continued until each observer had finished. A single observer surveyed only 2 fields a day, and generally did the same two fields throughout the study. The transect routes and order of field survey were varied to control any time bias. Observation of animals other than birds were recorded.

e. Casualty Searches - Treated field were systematically searched for any signs of affected (still alive) animals and mortality (whole carcasses, feather spots). Searches began 6 to 24 hours postapplication (2 days for the aerial application due to worker safety reasons) and continued daily up to and including the 10th day, then the 12th and 14th days after application. Searches were done regardless of weather conditions. Within 7 days prior to application one casualty search was done to remove carcasses or feather spots on fields.

The search transects ran along the perimeters of the fields. There were also two parallel transects in the interiors of the fields that were searched for the at-planting and at-cultivation applications. Intensive

searching was done 10 feet on either side of the transect line, but observations were not strictly limited to this area. Distinctive vegetation types in the edges were also searched. At these points, observers searched a line perpendicular to the transect (line identified by a marker). All fields had at least 8 markers.

The time to search was standardized, so that the search speed along the perimeters was 40 ft/min. Each field was searched each scheduled day. Although all 8 fields were treated at-planting, only four (CA, BE, FNII, and CNII) were searched this intensively. The other four fields (FNI, CNIII, BH, and SL) were searched less intensively, only 1 man hour/day. Transect routes were routinely alternated. Dead animals were collected, identified, labeled, and frozen for residue analysis.

f. Casualty Search Effectiveness - These efficiency trials were done after each casualty search period. There were 3 separate trials.

In trial #1, a known number of bobwhite quail carcasses were placed along either side of a transect located along the perimeter of an untreated field adjacent to CNII. Observers to be tested did not know the location of carcasses. Birds were not intentionally hidden, but were placed within a reasonable distance of the transect. Observers performed the normal search procedures to determine their efficiency within a set time period. Trials #2 and #3 were done in sections of SL and CNII.

g. Predator Removal Evaluation - The effects of predator removal and scavenging of carcasses were done at the end of each application phase. Banded bobwhite and/or mallard duckling carcasses were evenly placed in and around each study field within the regular search area. Four or five carcasses were placed inside each field, and the other carcasses were placed along the edges or just into the edge vegetation. Each carcass was marked by a small orange flag. Carcasses were observed 24 hours, 48 hours, and 72 hours after placement, and their conditions were noted.

h. Residue Analysis - Residue analyses were done on all carcasses to measure the amount of phorate. A separate study was done in the laboratory to determine if analytical methods were sensitive enough to measure residues of phorate and related metabolites in whole bird carcasses. Dosages of 15, 7.5, 3.25, 1.62, and 0 mg/kg were orally administered in corn oil to 4 groups of 5 male and 5 female bobwhite quails. These dosages were selected to include LD_{50} and LD_{20} doses. If

6

birds did not die from the dosing, they were sacrificed 24 hours after the dosing. If birds showed symptoms of poisoning, they were not sacrificed until they had recovered. All carcasses were analyzed for total CL 35,024-related residues.

A Tracor Model 550 gas chromatograph equipped with a flame photometric detector was used, and the limit of detection was 0.05 ppm.

i. Data Analyses - Avian survey results were transcribed from the sketch maps to computer worksheets. Data from each phase of the study were analyzed separately. No statistical analysis were done "due to the degree of variability in daily observations." Instead, the authors used direct observation of the data to detect biologically significant changes that may not be related to statistical significance.

Tables of data for each study site and study phase are: total number of bird observations, number of bird observations in the field, number of bird species and number of singing males.

Flock observations (> 10 birds) were recorded separately from observations of individual birds to prevent masking of potential changes in resident populations.

12. Reported Results:

a. At-Planting Application - Calibration indicated that 6.21 ± 0.33 oz/1000 ft or 1.35 lb ai/A were applied on 7 fields and 6.66 ± 0.74 oz/1000 ft or 1.44 lb ai/A on SL.

Bird Surveys

- 71 bird species identified during this phase. No apparent change in the numbers of species following application of Thimet 20G.

- Mean number of daily bird observations was 37 and ranged from 15 to 77, excluding flocks. No consistent pattern of change in total bird numbers in and around treated fields that could be attributed to Thimet.

- No apparent difference in the number of birds in the treated areas related to pre- and post-treatment observations.

- No apparent difference in the average number of singing males before and after treatment.

7

- Observations of other animals during bird surveys indicated there were many other vertebrates--eastern cottontails (Syvilagus floridanus) (most frequent), white-tailed deer (Odocoileus virginianus), squirrels (Sciurus sp.), snakes and turtles.

Carcass Searching

- Table 5 is a summary of observations. Approximately 400,800 ft of field edge were searched in 140 man-hours.

- Deaths of 2 birds (peacock and European starling) and one mammal (raccoon) may have been treatment related. These carcasses were found on 2 fields intensively searched. Peacock was found in the yard area of resident farmer on CA 5 days postapplication. Starling also on CA 8 days postapplication. Raccoon on FNII 7 days postapplication.

- According to investigators, there were 5 instances of animal remains on 4/8 fields after the application.

- Carcass search efficiency trial occurred on May 31, 1985, 32 days after the initiation of this phase of the study. Thirty-eight bobwhite carcasses were placed on a 850 to 900 ft transect along edge of field. Mean efficiency was 80 percent with a range of 74 to 89 percent (3 observers).

- Predator removal test was done on May 20, 1985. 15 carcasses (10 adult bobwhite and 5 mallard ducklings) placed on each of 7/8 fields (CA, BE, BH, FNI, FNII, CNII, and CN III). Fifteen similar carcasses placed on SL on May 21. The average percentages of removal at 24 hours, 48 hours, and 72 hours, respectively were: 30.1 $\pm$ 23.3%, 46.8 $\pm$ 31.1%, and 64.3 $\pm$ 25.5%.

b. Cultivation Application - Calibration indicated that 6.02 $\pm$ 0.29 oz/1000 ft to 6.24 $\pm$ 0.33 oz/1000 ft or 1.3 to. 1.35 lb ai/A were applied to all 4 fields.

Bird Surveys

- Fifty-seven bird species identified. No apparent changes in the number of species following treatment with Thimet.

- Mean number of daily observations (excluding flocks) was 38 and ranged from 15 to 59 birds. No consistent changes in total bird numbers in and around treated fields that were attributed to Thimet.

9

- A slight reduction in birds in treated portion of SL. There were no differences in the other fields regarding pre- and post-treatment observations.

- No apparent difference in the average number of singing males before and after treatment.

- Observations of other animals during bird surveys indicated there were numerous mammals and some reptiles.

Carcass Searching

- Table 12 is a summary of observations.

- Approximately 194,240 ft of field edge were searched in 81 man-hours.

- Deaths of 2 small mammals (shorttail shrew) and 1 bird (starling) attributed to Thimet. One shrew was found on BH 1 day after application, the second shrew was found on SL 5 days after application and the starling was found on BH 17 days after application.

- Other remains that were found, those of a great blue heron and nonspecific bones and feathers, were not considered to be treatment-related.

- Carcass search efficiency trial occurred on July 2, 1985, 29 days after the initiation of this phase of the study. Twenty-two adult bobwhite carcasses were placed along a 1500 foot transect on the field's edge. Mean efficiency was 53 percent with a range of 45 to 64 percent (3 observers).

- Predator removal test was done on June 24, 1985 on BH and CNIII, on June 27 on BE, and on June 28 on SL. There were 20 adult bobwhite carcasses in and around each field. The average percentages of removal at 24 hours, 48 hours, and 72 hours, respectively, were: 32.5 $\pm$ 10.5%, 52.5 $\pm$ 20.6%, and 56.3 $\pm$ 17%.

c. Aerial Application - Calibration indicated that the hopper opening was adjusted to deliver Thimet 20 g at a rate of 0.86 lb/sec. or 5.18 lb/A. Total applied to CNII and FNI was 250 lb or 6.4 lb/A. Total applied to CA and FNII was 250 lb or 6.6 lb/A.

Bird Surveys

- Fifty-seven bird species identified. No apparent change in the number of species observed following application of Thimet.

- A posttreatment reduction in observations noted for red-winged blackbirds (Agelaius phoenicus) on CA and chipping sparrows (Spizella passerina) on CA and FNII.

- Mean number of daily observations (excluding flocks was 31 and ranged from 11 to 71 birds. Appeared to be slight reduction in mean number of observations on CA after treatment.

- Reduction in number of bird observations in treated portion of CA.

- Slight reduction in average number of singing males per day on CA.

- Observations of other animals included a number of eastern cottontails and white-tailed deer.

Carcass Searching

- Table 19 is a summary of observations.

- Approximately 184,440 ft of field edge were search in 77 man-hours.

- Six dead birds, 2 dead mammals, and 1 feather spot found. Remains of one additional bird not considered to be treatment-related due to decayed condition.

- Large numbers of dead insects observed in fields and along edges within the first few days following application.

- Summary of carcasses found:

Species	Field	Days Postapplication
Carolina chickadee (Parus carolinensis)	CNII	2
Blackbird	CNII	2
Indigo bunting (Passerina cyanea)	CA	3
Grackle	FNII	4
Red-winged blackbird (Agelaius phoenicus)	CNII	5
Goldfinch (Carduelis tristis)	CA	6
Cottontail rabbit (Sylvilagus floridanus)	CA	7
Shorttail shrew	CA	12

- Carcass search efficiency trial occurred on August 12, 1985, 34 days after the initiation of this phase of

the study. Twenty-five adult bobwhite carcasses were placed along a 1000 ft transect along the edge of a field. A random numbers table was used to generate the location coordinates for placing each carcass. Mean efficiency was 50 percent with a range of 32 to 68 percent (2 observers).

- Predator removal test was done on July 30. There were 20 adult bobwhite carcasses in and around each field. The average percentage of carcasses removed at 24 hours, 48 hours, and 72 hours, respectively, were 22.5 ± 9.6%, 30.0 ± 15.8%, and 44.5 ± 19.6%.

d. Residue Analyses

1)

Species	Field	Date Found	Phase of Study	Days Post-Treatment	Residues*
Peacock	CA	5/12	At-Plant	5	<0.05
Raccoon	FNII	5/14	At-Plant	7	0.33
Starling	CA	5/15	At-Plant	8	<0.05
Shrew	BH	6/11	Cultivation	1	<0.05
Shrew	SL	6/21	Cultivation	5	<0.05
Starling	BH	6/27	Cultivation	17	<0.05
Blackbird	CNII	7/20	Aerial	2	<0.05
Chickadee	CNII	7/20	Aerial	2	0.33
Indigo bunting	CA	7/21	Aerial	3	0.09
Grackle	FNII	7/22	Aerial	4	<0.05
Blackbird	CNII	7/23	Aerial	5	<0.05
Goldfinch	CA	7/24	Aerial	6	0.05
Rabbit	CA	7/25	Aerial	7	<0.05
Shrew	CA	7/30	Aerial	12	<0.05

*Apparent total CL 35,024 (phorate)-related residues (ppm).

These results are based on whole-body residue analyses, including feathers or fur.

The validated sensitivity of the method was 0.05 ppm.

Specimens which could not be identified or consisted only of feathers and bones were not analyzed.

2) Results of Laboratory Bobwhite Quail Residue Study - The validated sensitivity of the method is 0.05 ppm. Apparent total CL 35,024-related residues were less than 0.05 ppm for the 1.62 and 3.25 mg/kg doses, equal to or less than 0.05 ppm for the 7.5 mg/kg dose, while residues ranged from 3.18 to 6.65 ppm for the 15 mg/kg dose.

13. Study Author's conclusions:

The methods used for the three phases followed those on the registered Thimet 20G label for applications to field corn.

At-Planting

- Avian surveys did not result in a "detectable impact" on local bird communities. Variability was attributed to weather, migration, season, or changes in avian behavior.

- Numbers of birds on the fields after treatment did not appear to change, although there was a strong odor of an OP pesticide for several days. Many of the birds on the fields were the common species, red-winged blackbird, common grackle, and northern cardinal.

- The deaths of 2 birds and 1 mammal appeared related to the application of Thimet. The partial remains of other animals precluded determination of cause of death.

- The dead peacock was one of several that lived adjacent to the study field and were seen in the treated field. Prior to finding the dead peacock, a peacock was observed with typical symptoms of OP poisoning, but it is unknown if this is the same bird.

- Raccoon tracks and scat were seen on FNII, where the carcass was found. There was also evidence of an animal excavating and possibly consuming the planted corn seeds. The investigators hypothesized that the dead raccoon was exposed to phorate through similar activities.

- The results of the carcass search efficiency trials and predator removal tests "are consistent with the results of other researchers."

- The investigators concluded that the small number of deaths indicate that there was not a significant effect on bird populations.

Cultivation

- Avian surveys' results were similar to those obtained during the earlier phase in that there was consistency in observations between the pre- and post-application periods.

- Overall, fewer bird species were observed on fields in this phase of study (57) compared to at-planting phase (71), and fewer birds seen in this phase. Differences attributed to reduced presence of birds throughout study area and "lesser degree of soil disturbance" during cultivation.

- Three dead animals and the partial remains of another (great blue heron) were found. The 2 mammals were shrews which are insectivorous and "may have been exposed to Thimet 20G through food items or through dermal contact while foraging in the corn fields."

- The investigators did not attribute the death of the starling to Thimet since the carcass was found 17 days postapplication, and it was in relatively good condition. Cause of death of the heron could not be attributed to Thimet.

- The investigators concluded that the small number of deaths indicate that there was not a significant effect on bird population.

Aerial

- Avian surveys' results were similar to those obtained during the two earlier phases.

- Fewer posttreatment observations on CA were not considered significant.

- Overall, fewer bird species and numbers of birds were seen in the fields in this phase of the study as compared to the 2 earlier phases. Adequate surveys of entire fields were hindered by growth of corn plants at this time.

- Some species, such as indigo bunting, use corn plants for perching.

- Six dead birds, 2 dead mammals, 1 feather spot found.

- Investigators hypothesized that mortality of birds occurred through direct ingestion of granules or contamination of food items. Numbers of dead insects seen on soil surface and granules were visible on plants and on soil.

- Investigators hypothesized that mammals may have died either through dermal poisoning or through ingestion of granules and/or contaminated food items. Mammal activity, including remnants of eaten corn cobs, observed in fields.

- Concluded, as above, that the mortalities caused by Thimet 20G did not cause any population effects.

14. Reviewer's Discussion and Interpretation of the Study:

a. Test Procedures

1) General Comments - At the time this study was done, 1985, there were no standard protocols, and EEB's Guidance Document for Conducting Terrestrial Field Studies was not developed. However, many of these biological research techniques used by field biologists and discussed in the Guidance Document were known at the time this study was conducted.

This field study will be evaluated according to how well the procedures and results simulated the real-world conditions of agricultural applications of a granular pesticide, exposure of wildlife to the pesticide and the ability of the field methods to detect any effects.

2) Study Sites - When the protocol was submitted to EEB for review in July 1985, the only data submitted on the selected sites were names, sizes, general location, and types of soil and vegetation. The descriptions and maps of the sites provided in this submission of the study indicate the Ferry Neck I and Ferry Neck II are basically adjacent to each other, as are Church Neck II and Churct Neck III. Therefore, FNI and FNII should be considered one field of approximately 45 to 50 acres, and CNII and CNIII are basically one field of 30 to 35 acres.

3) Avian Census - The avian census techniques were useful and appropriate to determine the species present on and around each study site, their relative numbers, locations, and activities. However, these methods are insufficient for a "population study" because the methods used did not address common population study parameters such as sex and year class distribution, breeding condition, nesting success, physiological conditions, etc. (The sex distribution and breeding conditions were only superficially addressed by cursory observations of "singing" males.) Migration and recruitment, although difficult to study, were also not addressed in this study.

The avian census was useful however, in determining the specific "pre- and post-" application use of the actual crop (tilled area) and of crop avoidance (or attraction) after application.

Unfortunately, no systematic census of mammals was undertaken in this study, although mammalian carcasses were found on some of the treated fields. Cursory observations of mammals and evidence of thei. activities in the fields (footprints, scats, etc.) provide evidence of their use of the corn fields and ability to become exposed to phorate by their activities.

4) Carcass Searching - Carcass search methods were generally done in accordance with the proposed methods. Unfortunately, the descriptions of the routes used in each field for carcass searching were vague and incomplete. In addition to transects along each field's perimeter, there were two parallel transects in the interior of each field for the first two phases of the study. However, we do not know if the transects ran lengthwise or across the widths of the fields. Obviously, more area would be covered if the transects ran lengthwise, and the more area covered the greater the likelihood of locating dead animals within the fields. The density of corn plant growth for the aerial phase was too great and precluded satisfactorily searching the interiors of the fields (verified by EEB staff site visit on July 17, 1985). There were additional search areas (at least 8 per field) that were perpendicular to the field edge marking distinctive types of vegetation. They do not specify the lengths of these transects or indicate how far they went into the interiors of the fields and the edge habitats. The locations and lengths of all transects should have been included in this report in order to know what portion of each field, including edge habitats, was actually search. The transect lines should also have been drawn on each of the scale maps included in this report to clarify these points.

   The width of the search area was 20 feet, 10 feet on each side of the transect line. This was accepted in our protocol review: however, we now believe that search efficiency would increase if the width of the search area were only 12 feet (6 feet on each side of the transect).

   The carcass searches for the cultivation and aerial applications should have been carried out for longer periods of time as carcasses and remains were found on the last scheduled search days for both of these phases.

5) Predator Removal and Carcass Search Efficiency Trials - The methodology used for the carcass search

efficiency trial was biased towards the observer finding hidden carcasses. This weakness in the study design was noted in our protocol review dated August 2, 1985 and was discussed with WIL biologists during our site visit. The carcasses were not randomly distributed but they were instead "placed within a reasonable distance of the transect (along which the observer walked) and will not be intentionally hidden." On our visit we noted that the vegetation along the edges of some fields (carcasses were placed along perimeters of fields) was relatively thick. Their method of placing the carcasses produced unrealistically high efficiency values as carcasses were not placed in the thick growth. We suggested they use a more randomized method for their third efficiency trial that was to be done in August at the end of the aerial phase. This report indicates they followed our suggestion as they used a random numbers table to generate the location coordinates for each carcass.

Also, the search efficiency trials were only conducted along the edges of one selected field for each phase of the study. Their efficiency values only indicate the ability of the observers to locate carcasses along edges of certain types of vegetation (which were not specified in the report) and not the ability to find carcasses throughout an entire study site, including a variety of edge vegetation.

For these reasons, the effectiveness of the efficiency trials to predict the ability of observers to find whole or partial carcasses is rather low.

The predator removal tests were conducted in a satisfactory and systematic manner. Our use of the data from these trials would have been greater if they indicated the percentages intact and scavenged on the fields vs in the edge vegetation.

6) Residue Analyses - The analyses for the determination of total phorate-related residues in bobwhite quail given different oral doses of technical phorate indicate that residues greater than the limit of detection were not detected in whole bodies until a dose equivalent to the LD_{50} (15 mg/kg) was given. The use of whole bodies may have diluted the residues. It is possible that detection would have been greater if only the digestive tract or organs such as breast muscle or liver were individually analyzed. Therefore, the failure to detect residues in carcasses cannot be interpreted as lack of a pesticidal effect.

116

In their report of the results of the laboratory test, they should have indicated which birds died from the dosing and which birds were sacrificed were sacrificed after recovering from the signs of poisoning.

7) Data Analysis - We agree that this study was a qualitative and not a quantitative field test. Therefore, statistical analyses are not meaningful.

b. Results and Discussion

1) At-Planting - The calibration methods and results were acceptable.

When the data from the avian censuses were examined, it was noticed that the data tables in Appendix IX were incomplete. The tables titled, "Bird Observations by Species in the Treated Field" do not list all the birds observed each day. This fact becomes evident when these tables are compared to the tables "Summary of Daily Bird Observations by Study Site", and it is seen that the number do not agree.

The tables indicate that the fields were used extensively by wildlife before and after treatment. The mean densities on the 4 censused fields were:

Field	Pretreatment (Birds/A)	Posttreatment (Birds/A)
CA	1.9 ± 0.3	2.0 ± 0.3
BE	2.0 ± 0.7	1.3 ± 0.4
CNII	2.8 ± 1.7	2.2 ± 1.2
FNII	2.7 ± 0.9	2.5 ± 1.2

The tables indicate that the most common bird species on the four fields that were censused (CA, BE, CNII, and FNII) were the common grackle, American robin, red-winged blackbird, northern cardinal and chipping sparrow. It appears that their statement that there was no consistent pattern of change in bird species composition or abundance following treatment is accurate for the species listed. However, we need the complete listings before that conclusion can be completely accepted.

In this phase of the study, two whole bird carcasses, a peacock and a starling were discovered on CA and a raccoon carcass was found on FNII. In addition, there were numerous incidents of animal remains and feather spots of mammals and birds on 7/8 treated fields. The data do not allow one to make any con-

clusions about the effects on bird populations from applying Thimet at-planting. However, we need to consider if the level of mortalities from the at-planting application of phorate is significant. The number of carcasses found on a study site is dependent not only on the number of animals killed by the pesticide but also the number of animals using the site, the number of carcasses removed by predators/scavengers, the ability of observers to locate the carcasses and the amount of each site that is searched.

Four of the fields (CA, FNII, BE, CNII) were searched more intensively than were the other four treated fields. Their description of search transects indicates that the edges were more thoroughly searched than were the interiors of the fields. A total of 400,800 ft of transect, 20 ft wide was searched during 140 man-hours. This is equal to searching 184 acres of field over a period of 8 to 12 days depending on the day of application. The total acreage that was available for carcass searching was calculated by multiplying the acreage of each field by the number of days the field was searched, starting with the day of application. This number is 1798.4 acres. Only 184 acres were searched, however. Therefore, at most, only about 10 percent of the total treated acreage was searched for carcasses each day. Because they failed to break down the total distance searched to distance per individual field, we do not know what proportion of each field was searched. However, this level of search effort is very small, even on the 4 fields more thoroughly searched.

The three carcasses were found on the fields more thoroughly searched. This illustrates that the more area covered during carcass searching, the greater the likelihood of finding them. Also, the carcasses were found in the edges (the peacock was in the neighboring yard), but only 10 feet of the edges were searched on transects that followed the perimeters. It is feasible that more carcasses would have been found if more edge habitat was searched.

Also, there was a high degree of predator/scavenger activity, which also affected the ability to locate carcasses. We believe we are justified in considering the remains discovered on the fields as possibly related to phorate. It is not common to find remains of dead animals on a number of fields on a relatively continuous basis as occurred in this phase of the study. As demonstrated by Rosene and Lay (1963)

locating even a few carcasses indicates that a number of animals died. As indicated by Balcomb (1986) bird carcasses will "rarely be found at the onset of . . . death after exposure to pesticides." Since the pressure from predator/ scavenger activity was high, greater efforts (i.e., more area searched) should have been made to locate carcasses.

The small number of bird carcasses found in this phase of the study cannot be interpreted as a lack of effect. Their significance is obscured by the small effort of searching for carcasses and the high rate of scavenger pressure.

Finally, when the study was designed we were primarily concerned with the effects of phorate on birds, as our toxicology data and field incident reports indicated birds were clearly at risk. However, finding a raccoon carcass is very significant as it indicates the effects of phorate on mammals were underestimated.

2) Cultivation - The calibration methods and results were acceptable.

When the data from the avian censuses were examined, it was noticed that the data tables in Appendix XIII were incomplete as they do not list all the birds observed each day. This problem was discussed above in the evaluation of the "at-planting" phase.

The tables indicate that the fields were used extensively by wildlife before and after treatment. The mean densities on the 4 fields were:

Field	Pretreatment (Birds/A)	Posttreatment (Birds/A)
BE	1.8 ± 0.5	1.9 ± 0.3
BH	1.3 ± 0.2	1.3 ± 0.3
SL	4.7 ± 2.0	4.4 ± 0.9
CNIII	2.3 ± 0.4	2.5 ± 0.7

The tables indicate that the most common bird species on the 4 fields was the common grackle: the red-winged blackbird was common on 3 fields and the crow, robin, cardinal, and mockingbird were common on 2 fields. It appears that their statement that there was no consistent pattern of change in bird species composition or abundance following treatment is accurate for the species listed. However, we need the complete listings before that conclusion can be completely accepted.

In this phase of the study, carcasses of a shrew and a starling were found on BH and that of another shrew on SL. All carcasses were found along the edges of the fields. Not as many remains and fragments of dead animals were found on the fields in this phase of the study as compared to the earlier phase. The data do not allow one to make any conclusions about the effects on bird populations from applying Thimet during cultivation. As discussed in the evaluation of the "at-planting" phase, the significance of the mortality needs to be considered.

A total of 194,240 ft of transect, 20 ft wide, was searched during 81 man-hours. This is equal to 89.2 acres of field over a period of 8 to 13 days depending on the day of treatment. The total acreage that was available for carcass searching was calculated to be 689.9 acres. Only 89.2 acres were searched, however. Therefore, at most only about 13 percent of the total treated acreage was searched for carcasses each day. This level of search effort is very small.

As we discussed in the previous section, only 10 ft of the edges were searched on the transects that followed the perimeters. As the three carcasses were discovered along the edges, it is feasible that more carcasses would have been found if more edge habitat was searched.

Also, there was a high degree of predator/scavenger activity, which also affected the ability to locate carcasses. We believe we are justified in considering the remains of animals, including that of the great blue heron, as possibly related to the fields' treatments with phorate. It is not common to find remains of dead animals on a number of fields. As demonstrated by Rosene and Lay (1963) locating even a few carcasses indicates that a number of animal died. As indicated by Balcomb (1986) bird carcasses will "rarely be found at the onset of . . . death after exposure to pesticides." Since the pressure from scavengers was high, greater efforts (i.e., more area searched) should have been made to locate carcasses.

Finding a small number of bird carcasses cannot be interpreted as a lack of effect. The significance is obscured by the small amount of area that was searched and the high rate of predator/scavenger pressure.

Finally, when the study was designed we were primarily concerned with the effects of phorate on birds, as our toxicology data and field incident reports indicated birds were clearly at risk. However, finding two shrew carcasses is very significant as it indicates the effects of phorate on mammals were underestimated.

3) Aerial - The calibration data indicated that they measured the amount of Thimet granules delivered through the hopper openings. They apparently did not determine the amount actually applied to fields. We had asked them to take photographs of the granules in the whorls of the corn plants, but no photographs were included with this report. They calculated that 6.4 lb Thimet 20 G per acre were applied to CNII (13.9 A) and FNI (25 A) since 250 lb total were delivered to the two fields. They also delivered 250 lb to CA (28.8A) and FNII (20.1A), which they calculated to be 6.6 lb Thimet 20 G per acre. Our calculations for the amount of Thimet 20 G applied to CA and FNII do not agree with theirs. A delivery of 250 lb to 48.9A is equal to 5.1 lb Thimet 20 G. If they applied 6.6 lb/A, then the total poundage was 323 lb, not 250 lb. Their nominal rate of delivery was 5.1 lb/A.

When the data from the avian censuses were examined, it was noticed that the data tables in Appendix XVII were incomplete as they do not list all the birds observed each day. This problem was discussed earlier in the evaluation of the earlier phases.

The tables indicate that the fields were used extensively by wildlife before and after treatment. The mean densities on the 4 fields were:

Field	Pretreatment (Birds/A)	Posttreatment (Birds/A)
CA	2.0 ± 0.3	1.4 ± 0.5
CNII	1.9 ± 0.2	1.8 ± 0.9
FNI	0.9 ± 0.2	0.8 ± 0.2
FNII	2.4 ± 1.1	1.6 ± 0.5

It appears that there was a reduction in bird density on CA and FNII after the aerial application. However, the changes may not be related to the chemical, but may be natural temporal variations. However, the method of data collection does not allow for an explanation of the variations.

The tables indicate that the northern cardinal, indigo bunting and chipping sparrow were common on 3

22

of the 4 fields. The authors acknowledge changes in species composition on CA and FNII, however, we need the complete listing of species for each site to know if this trend was limited to 2 species on these 2 fields.

In this phase of the study, bird carcasses were discovered on FNII, CNII, and CA, and mammal carcasses were found on CA. All carcasses except one, a Carolina chickadee on CNII, were found in the edge habitat. Also, a number of dead insects were seen in and around the fields. Not as many remains and fragments of dead animals were found in this phase of the study as compared to the "at-planting" phase. The data do not allow one to make any conclusions about the effects on bird populations from the aerial application of Thimet. As discussed in the evaluations of the other phases, the significance of the mortality needs to be considered.

A total of 184,440 ft of transect, 20 ft wide, was searched for 10 days after treatment. This is equal to 84.7 acres of field. The total acreage that was available for searching during the 10-day search period was calculated to be 878 acres. Therefore, less than 10 percent of the total treated acreage was searched for carcasses. This level of search effort is very small.

As we discussed in the previous sections only 10 ft of the edges was searched on the transects that followed the perimeters. As most of the carcasses were discovered along the edges, it is feasible that more carcasses would have been found if more edge habitat was searched.

There was less predator/scavenger activity in this phase of the study as compared to the two earlier phases (49% intact in this phase vs. 18% and 15% intact in the earlier phases). As discussed previously, it is possible that the feather spot discovered on CA was the remains of a bird poisoned by phorate.

Finally, the study was designed to study the effect of phorate on birds. However, the deaths of a shrew and rabbit indicate we underestimated the effects of phorate on mammals.

More carcasses were found after the aerial application than after the earlier two methods of application. In the at-planting and cultivation methods, the

granules are covered with soil, although these methods do not completely incorporate the granules. However, during an aerial application, the granules are sprayed into the whorls of the corn plants. These granules are accessible to birds, particularly songbirds which were observed perching on the leaves of the plants. However, some granules do fall through the corn plant canopy and reach the soil as shown by the deaths of the rabbit and the shrew. It appears that the degree of mortality is also a function of the method of application of granular phorate. The aerial application appears to be the most hazardous to birds and mammals.

c. Conclusions

1) Category - Supplemental

2) Rationale - The study is scientifically sound and demonstrates that the application of Thimet 20 G (ai-phorate) to corn can kill birds and mammals. The aerial application appeared to be more hazardous than the at-planting and cultivation methods due to the greater availability of the granules. The study does not completely fulfill the data requirement for a terrestrial field study as the methods used did not permit a quantification of mortality and an estimate of avian and mammalian population effects. Interpretation of the study is hampered by high predator/scavenger activity and the small amount of treated area that was searched for carcasses.

3) Reparability - A level II terrestrial field study is required to quantify population effects.

Phorate ecological effects review

Page _____ is not included in this copy.

Pages 24 through 87 are not included in this copy.

The material not included contains the following type of information:

___ Identity of product inert ingredients

___ Identity of product impurities

___ Description of the product manufacturing process

___ Description of product quality control procedures

___ Identity of the source of product ingredients

___ Sales or other commercial/financial information

___ A draft product label

___ The product confidential statement of formula

___ Information about a pending registration action

X FIFRA registration data

___ The document is a duplicate of page(s) _____

___ The document is not responsive to the request

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.