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VERTEBRATE DAMAGE CONTROL RESEARCH IN AGRICULTURE

INVESTIGACIONES SOBRE EL CONTROL DE DANOS CAUSADOS POR LOS VERTEBRADOS EN LA AGRICULTURA

1972 ANNUAL REPORT
INFORME ANUAL 1972

PALMIRA, COLOMBIA
RESEARCH CENTER
CENTRO DE INVESTIGACIONES

Cooperating Agencies
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CALI, COLOMBIA FIELD STATION
1972 ANNUAL PROGRESS REPORT*

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Agency for International Development
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Denver Wildlife Research Center
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* Results Incomplete and Not for Publication, Release, or Use Without Authority of the Director, Denver Wildlife Research Center

** Dr. Vogel, Mr. Bojorge and Dr. Sequeira are with the Banco Nacional de Nicaragua and are not on the field station staff.

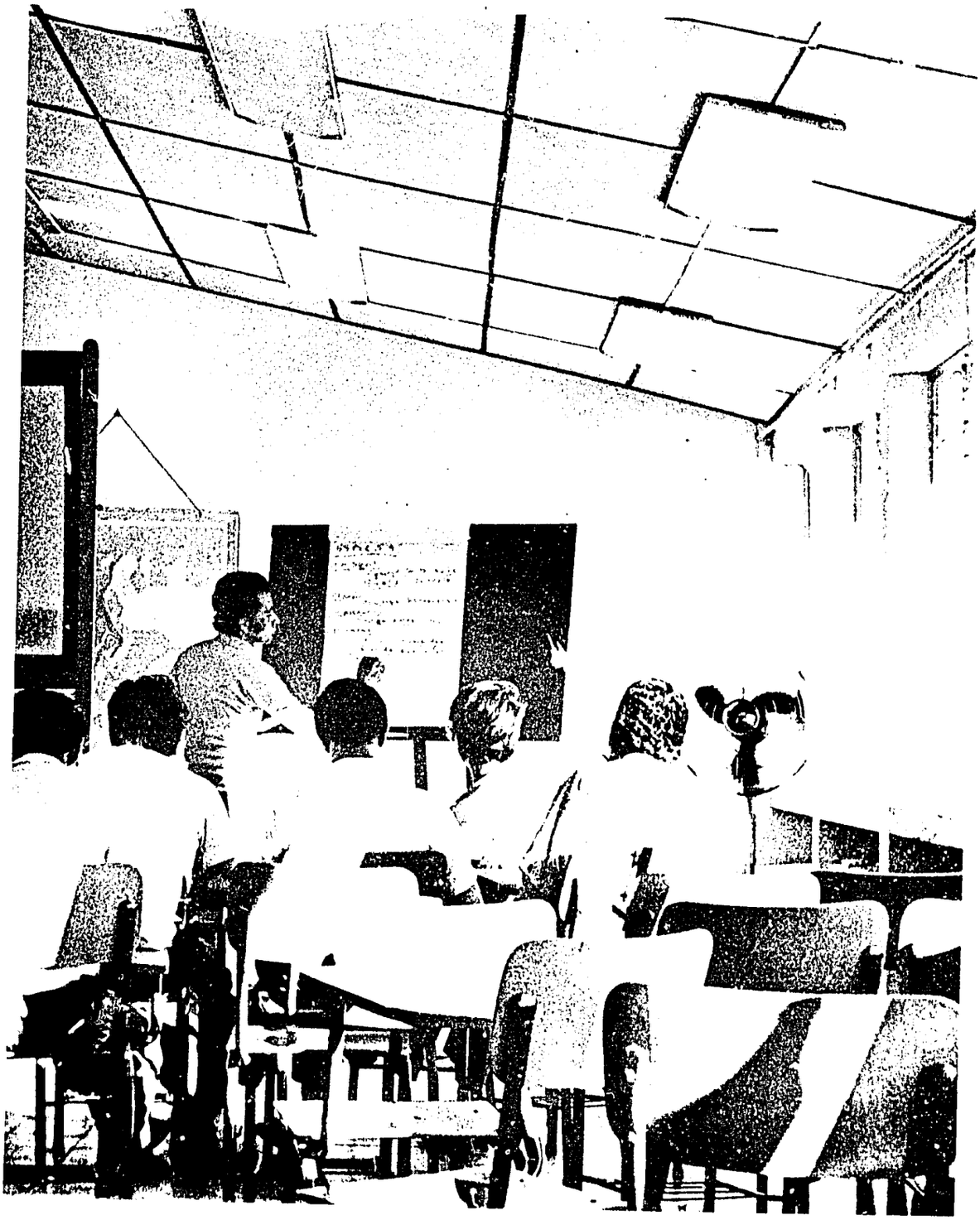

Fig. 1. Danilo Valencia giving a seminar on vertebrate damage problems and control in rice at a Fedearroz Meeting.

ABSTRACT*

Rodent damage surveys conducted in three important coconut-producing areas of Colombia indicated that damage ranged from light to very heavy and was caused by two different species. Control trials using anticoagulants will begin in 1973.

The eared dove (Zenaida auriculata) has not caused serious agricultural problems in the Cauca Valley this year which has limited field studies.

The effectiveness of Methiocarb (DRC-736) as a soybean seed repellent for eared doves was field tested, but the results were inconclusive. Soybean seeds treated with Methiocarb were tested for germination and survival. The treatment seemed to enhance germination but slightly reduced the plant survival rate. Simulated dove damage studies indicated that certain types of damage may not effect plant survival but seem to reduce plant yields.

Other vertebrate damage problems were worked on in Colombia. Ground baiting with 4-aminopyridine (DRC-1327) was successful in frightening shiny cowbirds (Molothrus bonariensis) from experimental corn plantings. Unprofitable trips were made to the Plains to investigate a dickcissel (Spiza americana) problem in rice and to Monteria to conduct studies on parakeet damage to maturing corn. Black vultures (Coragyps atratus) were observed causing severe damage to oil palm fruit near Turbo, but initial attempts to control the problem were unsuccessful.

Work continued on the ricefield rodent problem in Nicaragua, but some studies were postponed because of a low rodent population. Also, in Nicaragua, preliminary observations were made on dickcissel (Spiza americana) damage to rice crops. Field trials will be initiated in 1973.

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* This research was conducted with funds provided to the Bureau of Sport Fisheries and Wildlife by the Agency for International Development under the project "Control of Vertebrate Pests: Rats, Bats, and Noxious Birds," PASA RA(ID) 1-67.

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INTRODUCTION

Objectives

The objectives of the program are to conduct research aimed at developing safe, effective, and economical methods of reducing crop losses caused by birds and mammals; and to develop Latin American capabilities in the field. Colombia was selected as the station site because of its central location in Central and South America.

Program

The project has moved into permanent quarters, but several items still require installation or modification before the facilities can be fully operational.

Dr. Luis H. Camacho, Colombian Director of this project, departed on 27 May for a year sabbatical. Sr. Silvio Hugo Orozco replaced Dr. Camacho.

Jose Fernando Londono was awarded a USAID training grant and left in September to do graduate work in wildlife ecology at the University of California, Davis. Because of financial difficulties, the Instituto Colombiano Agropecuario (ICA) was unable to replace Mr. Londono, and the loss may handicap project activities.

Paul P. Woronecki and Donald J. Elias took home leave during the year.

Mr. Weldon B. Robinson, AID consultant, visited the project in late November to make preliminary arrangements for a vampire bat control workshop. The workshop is tentatively planned for Valledupar, Colombia, in August 1973.

RESEARCH ACTIVITIES - COLOMBIA

Investigations of the Extent and Economic Importance of Vertebrate Damage to Agricultural Crops in Colombia

Introduction

Vertebrate damage in Colombian agriculture was summarized in the 1970 and 1971 Annual Reports. Whenever possible, station personnel investigated the damage to delineate the problems and to determine where research should be directed. Tables 1 and 2 list reports of vertebrate damage in addition to those presented in 1970 and 1971.

TABLE 1. Location of additional bird damage to agricultural crops in Colombia, 1972

Location	State	Common name		Scientific name	Crop and stage	Time
		English	Spanish			
San Juan de la Costa	Narino	Small birds	Chiri	Unknown	Rice - Maturing	Unknown
San Juan de la Costa	Narino	Blackbirds	Chango	Unknown	Rice - Mature	Unknown
San Juan de la Costa	Narino	Dove	Tortola	Unknown	Rice - Mature	Unknown
San Juan de la Costa	Narino	Jacana	Culi rota	*Jacana sp.*	Rice - Standing (knocking over)	Unknown
San Juan de la Costa	Narino	Ducks	Patos	Unknown	Rice - Standing and Mature (knocking over)	Unknown
Guacamayal	Magdalena	Small birds (black and white)	Arrocero	Unknown	Sorghum - Maturing	February
Guacamayal	Magdalena	Parakeets	Cotorras	*Aratinga pertinax*	Sorghum - Maturing	July-August
Valle del Cauca (CIAT)	Valle	Cattle Egrets	Garzas	*Bubulcus ibis*	Rice - Standing (knocking over)	September
Valle del Cauca (CIAT)	Valle	Blue-gray Tanager	Azulejo pitojue	*Thraupis virens*	Tomatoes - Maturing	All year

TABLE 2. Location of additional mammal damage to agricultural crops in Colombia, 1972

Location	State	Common name		Family	Crop and stage	Time
		English	Spanish			
Valle del Cauca (CIAT)	Valle	Opposum	Chucha	Didelphidae	Tomatoes - Maturing	All year
Ipiales	Narino	Rats	Ratas	Rodentidae	Beans	January
Unguia	Choco	Rats	Ratas	Rodentidae	All crops	Recent*
	Cesar	Vampire bats	Vampiros	Desmodontidae	Cattle	All year
	Guajira	Vampire bats	Vampiros	Desmodontidae	Cattle	All year
Mutata, Guapa y Debeida	Antioquia	Vampire bats	Vampiros	Desmodontidae	Cattle	All year
Yunquita	Narino	Vampire bats	Vampiros	Desmodontidae	Cattle	All year
Turbo	Antioquia	Bats	Murcielago	Unknown	Bananas - Maturing (scratching the fruit)**	All year

* According to reports from the area, a problem that has recently developed.

** Other reports indicate that this damage is not bat damage but insect damage.

Procedures

Investigations were made of most reported problems and follow-up information was requested. The information received determined if continued investigation was justified.

Results and Discussion

The following items appeared to be the most serious problems in Colombia and continued research will be concentrated in these areas.

Although several mammalian species are reported to cause agricultural problems in Colombia, rats (*Rattus rattus*) to coconut is considered the most serious problem. Also, an increasing number of serious rat-damage reports in rice and other crops warrant investigation.

The eared dove (*Zenaida auriculata*) has been considered the most serious bird pest in Colombia, especially in the Cauca Valley, and is a serious vertebrate pest in other South American countries. During the past 2 years damage to soybeans and sorghum in the Cauca Valley appeared less severe, possibly because of reduced soybean acreage and a change in agricultural practices which make crops less vulnerable to doves. An increase in soybean planting is anticipated in 1973, and eared dove damage may also increase. The dickcissel is also a serious agricultural pest in many countries of Central and South America. The bird is migratory and it causes seasonal, sporadic, and irregular damage. Both dickcissel and eared dove problems continue to warrant investigation.

Evaluation of Rodent Damage to Coconuts in Colombia

Introduction

Rodents cause serious coconut losses in nearly all coconut-growing countries (Strecker, 1962; Smith, 1967). Colombia has an estimated 175,000 acres suited for coconut cultivation on the Atlantic and Pacific Coasts and on the island territories (Sanchez and Mean, 1971). Rodent damage has been reported in each area, but no measurements of damage have been made. A study was conducted to evaluate the extent of rodent damage in three major coconut-growing areas of Colombia.

Procedures

A sample plot containing at least 250 palms was selected on each of three study areas: San Andres Island in the Caribbean, Santa Marta on

the Atlantic Coast, and San Juan de la Costa Island on the Pacific Coast (Fig. 2). Techniques developed by the Coconut Industry Board of Jamaica were followed in establishing and carrying out rodent damage surveys. One hundred palms were randomly selected and marked for identification in each sample plot. All new rodent-damaged nuts on the ground beneath these palms were recorded for a period of 3 weeks and the percent of damage was calculated. Specimens of the damage-causing rodents were captured in each area and submitted to the Museo de Historia Natural, Cali, for identification. In addition to the damage survey, crowns of 50 randomly selected palms on San Andres Island were inspected for evidence of rat activity.

Results and Discussion

The roof or ship rat (Rattus rattus) is the major species involved, although other rodents cause damage in some areas. In the Santa Marta region a tree squirrel (Sciuris granatensis) is the most serious pest. The Norway rat (Rattus norvegicus), although present in many coconut areas, causes no known damage (Smith, 1967).

San Andres Island.--This survey was done in a commercial plantation on the farm of Mr. Delvin May. Results show a loss of 38.76 nuts per palm per year. With an annual production of approximately 50 nuts per palm, losses directly attributable to rats is 77.5%.

In 50 palm crowns checked for rat activity we observed 27 with no activity, 12 with chewed nuts and nests, and 11 with chewed nuts only (includes nuts completely opened or only scarred). In all, 46% of the crown showed some type of activity.

Plans are underway for field baiting trials on San Andres Island in 1973.

Santa Marta Area.--Two surveys were carried out, one on Hacienda Butitaca and the other on Hacienda Guachaca. In both plots, one half of the sample trees were selected in an area adjacent to the beach away from the jungle, and half away from the beach and adjacent to the jungle. All damage noted in this region was caused by S. granatensis (Fig. 3). No evidence of damage by R. rattus was noted (Fig. 4).

Losses on Hacienda Buritaca were about 2.5 nuts per palm per year and on Hacienda Guachaca approximately 2.0 nuts per palm per year, resulting in damages of about 5% and 4%, respectively. In both areas, the damage occurred adjacent to the forest, and was localized in four or five palms. In Buritaca one tree had eight damaged nuts and in Guachaca there was one with six. This evidence indicates that relatively few animals are involved and their activities are probably restricted to a small number of feeding sites.

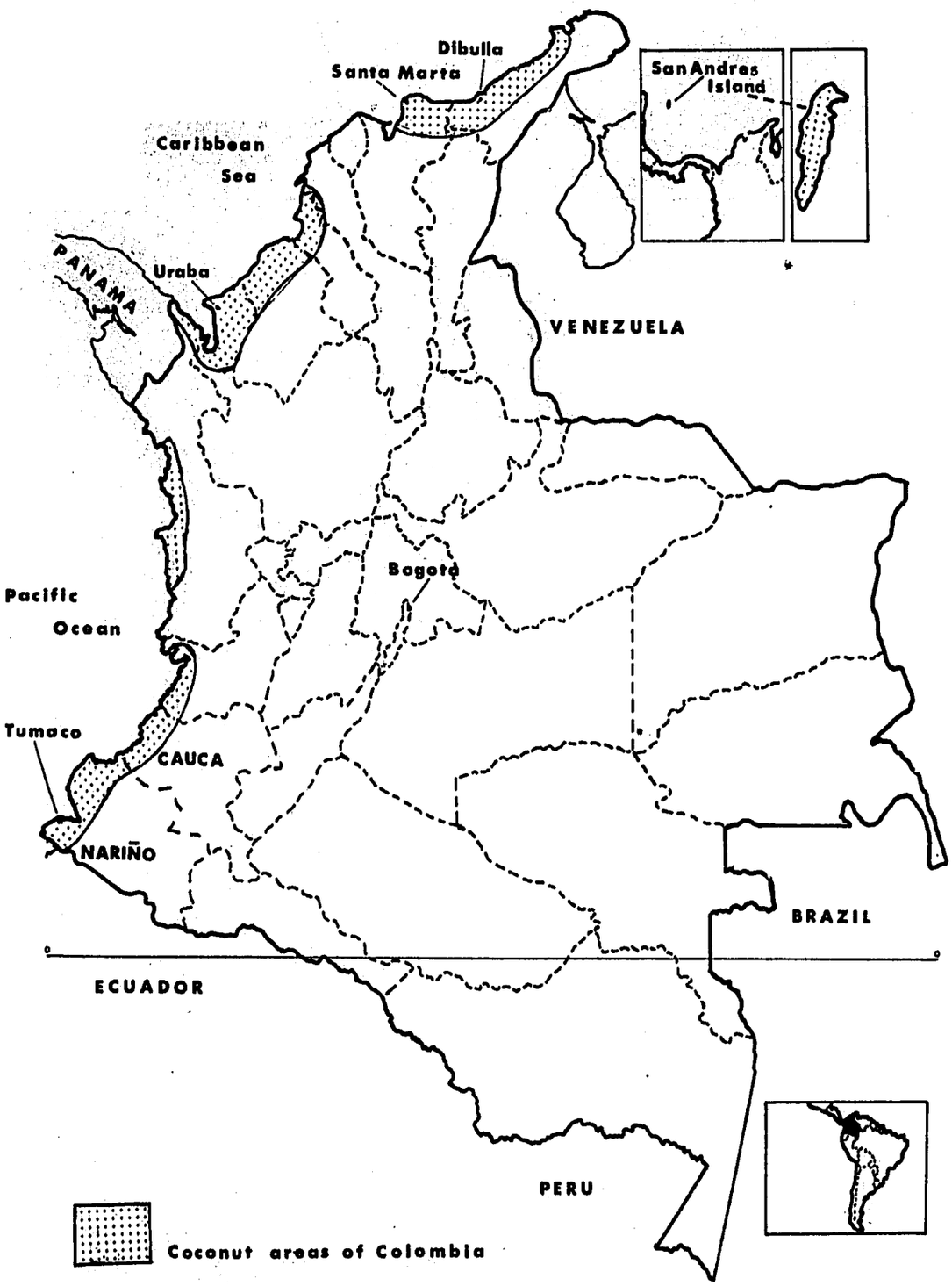

Fig. 2. The coconut growing areas of Colombia.

Fig. 3. Coconuts damaged by tree squirrels (S. granatensis).

Fig. 4. Coconuts damaged by roof rats (*Rattus rattus*).

San Juan de la Costa Island.--The sample plot was located in an experimental coconut plantation maintained by the ICA Experiment Station "El Mira" near Tumaco. Losses were about 16.3 nuts per palm per year or 32.6%. It is noteworthy that almost 39% of the damaged nuts come from trees fitted with metal bands used to prevent rats from climbing the trees. Banding is an accepted control method used worldwide.

Control of Eared Dove Damage in the Cauca Valley

Introduction

The eared dove is reported to cause serious agricultural damage in Argentina, Uruguay, and Trinidad, as well as in Colombia. In many countries this dove is prized both as a game bird and for food (Olivares, 1970; Johnson, 1967). The present population in the Cauca Valley has stimulated both local and foreign hunting interests--at the same time, requests for population reduction are being received from soybean and sorghum growers.

According to many reports, dove problems in the Cauca Valley have become serious in the past 5 years. Documentation of whether the increase is due to a population increase or a change in feeding habits or both has not been made.

In 1971, data was accumulated on food habits, breeding seasons, and other aspects of eared dove ecology. This year the studies were designed to field test the effectiveness of Methiocarb (DRC-736) as a repellent, and to try to develop a damage evaluation technique for soybeans. Thompson and Agudelo (1969) showed that treating soybean seed with DRC-736 may have been effective in reducing eared dove damage to emerging soybeans in an experimental planting near Palmira.

Populations and Damage

Procedures

Data was accumulated by field observation and specimen collection throughout the Departmento del Valle.

Results and Discussion

During January and February, the first large concentrations of doves were observed near La Union associated with corn harvesting. However,

damage to corn or rice has not been verified because the doves seem to feed only on spillage in these crops. By March very few doves were in the area and by mid-March they were scarce. The first report of damage to newly planted and emerging soybeans was received in early March from a farm between Zarzal and La Victoria. Late planting and replanting efforts (bad seed and/or dove damage) seemed to have concentrated the doves on this large farm. No other reports of serious damage were obtained because most of the soybeans in the valley were planted early. Doves were scarce in the Cauca Valley until October and attempts to locate concentrations for laboratory and biological examination were in vain. Around mid-October and early November, groups of doves appeared around Palmira, but soon disappeared. At the same time large groups of shiny cowbirds, yellow-hooded blackbirds (Agelaius icterocephalus), seed-eaters, and shorebirds were quite evident in the same area; evidently some type of seasonal migration.

The influx of doves into the valley and the resultant crop damage is usually associated with the beginning of the rainy season. Apparently rains in the mountains and foothills drive the birds into the Valley for food. By mid-October (before the rains commenced) most of the crops were already planted and no serious dove damage was expected or reported.

We believe that the doves in the Valley have recently increased because intensive agriculture now provides food materials (weeds, sorghum, rice, corn, and soybeans) during periods when natural foods were probably scarce. We suspect the increase may be temporary or may become cyclic. The dove problem has not been as serious in the past 2 years, and recent populations and damage have been unpredictable.

Food Habits and Biology

Procedures

Eared doves were collected, the contents of their crops and gizzards were saved for identification, and their reproductive organs were examined.

Results and Discussion

During 1972, only 62 doves were collected and examined. Table 3 shows the relative sizes of their reproductive organs, and Table 4 lists a portion of the weed seeds found in addition to the seeds of five crops that were identified and reported last year. The weed seeds were identified with the assistance of Dr. Jerry Doll of CIAT. Several specimens remain to be identified and a number of crops and gizzards have not been examined. Eared doves may be responsible for disseminating as well as destroying weed seeds.

TABLE 3. Measurements of reproductive organs of eared doves collected in the Cauca Valley, 1972

Month	Number collected		Testes measurements		Ovary measurements	
	Male	Female	Mean	Range	Mean	Range
January	14	20	1.6	1.3-2.1	0.5	1.1-1.7
February	6	6	1.4	0.5-2.0	0.2	0.1-1.0
March	8	8	1.7	1.2-2.1	1.1	0.1-3.0
Total	28	34	1.6	0.5-2.1	0.6	0.1-3.0

Control

Procedures

ICA-Lili soybean seeds were treated with 0.5% DRC-736 (Methiocarb) in a water slurry and planted on a farm in the Roldanillo Irrigation District for conducting field trials on the effectiveness of this chemical repellent in reducing dove damage to emergent soybeans. We attempted to obtain 15 plots (one-half hectare each) to plant treated soybean seeds but only found two interested growers and only one would hold off planting until dove damage appeared likely.

In March two 1/2-acre test plots on "La Cabana" Farm were planted with DRC-736 treated soybeans and two reference plots were planted with untreated seeds. One of the treated plantings also received a top dressing of treated seeds 3 days after planting when most of the seeds remaining on the surface were eaten by the doves. One of the two reference plots was protected by bird scarers and the other was not.

Results and Discussion

For several days immediately following planting, doves were found dead from eating the treated seeds left on the surface during planting. Doves were observed feeding in the fields before planting, planting day, and for several days following. Doves did not exhibit any fright, emit calls, or frighten other doves from the field. They simply stopped eating after 5-10 minutes and left the field.

TABLE 4. Weed seeds eaten by eared doves in the Cauca Valley, 1972.

Family	Scientific name	Common name
Malvaceae	*Sida rhombifolia*	Escoba
Convolynaceae	*Ipomocea hederifolia*	Batatilla
Leguminosae	*Desmodium sp.*	Pega pega
Graminea	*Digitaria sanguinalis*	Guaderocio
	Echinochloa colonum	Lindre puerco
	Paspalum notatum	Pasto bahia
	Paspalum sp.	La amarilla
Cyperaceas	*Cyperus diffusus*	Cortadora
Amaranthaceae	*Amaranthus sp.*	Bledo
Labiatae	---	---
Euphorbiaceae	*Caperonia palustris*	Botoncillo
	Euphorbia hecerophylla	Gota de Sangre
	Euphorbia hypericifolia	Lecherito
Cucurbitaceae	*Momerdica chanantia*	---
Solonaceae	---	---
Verbenaceae	*Bouchea priomatica*	Verbena

On planting day, two specific doves fed for approximately 8-10 minutes and then flew to a nearby tree where they were found dead 45 minutes later. Death was attributed to consuming a large number of surface seeds. Usually, doves found dead had eaten very few soybeans, while affected doves had up to 14 seeds in their crops, and doves shot in the area had up to 55 soybean seeds in their crops. When germination was at its peak, several piles of up to 30 soybean cotyledons were found in the treated fields near affected doves (Fig. 5). We assumed that these were regurgitated by the doves after eating remaining treated seeds. During this period, it appeared that more doves were visiting the untreated fields.

Fig. 5. Germinated soybeans assumed regurgitated by eared doves after eating some seeds treated with DRC-736.

In April three additional 1/2-hectare fields were planted (two treated and one untreated). One of the treated fields was protected by bird scarers while the other was not. No dead doves were found after this planting, probably because of fewer doves in the area or because the majority of the birds were frightened from the fields.

After all fields were cultivated, a 10% sample of the test fields was taken. Unfortunately, a sample could not be taken in one reference field because the tractor driver decided to plow it under since very few plants remained.

Further observations were canceled because a rainstorm dropped 56 mm of rain within 2 hours and destroyed parts of our test plots.

The data that were salvaged permitted no concrete conclusions (Table 5).

TABLE 5. Average (and range) number of plants in a 10% sample of soybean test fields.

Date	Treatment			
	0.5% DRC-736 seeds - no bird scarers	0.5% DRC-736 seeds with bird scarers	Commercial seeds - no bird scarers	Commercial seeds with bird scarers
March 1972*	3.0(0.3-6.4)	3.8(0.0-13.0)	1.0 (one treatment only)	2.3(0.1-4.7)
April 1972**	1.2(0.0-2.8)	0.9(0.0-2.9)	1.4(0.0-3.6)	Not attempted
Average	2.1(0.0-6.4)	2.4(0.0-13.0)	1.2(0.0-3.6)	

* Influenced by heavy rain.
** Influenced by heavy rain and late planting.

Germination of DRC-736 Treated Soybean Seeds (ICA-Taroa)

Procedures

Seven treatments and four replications were conducted to test the effects of DRC-736 on the germination of soybean seeds (100 seeds each). The treatments are shown in Table 6. The seeds were planted in sand flats and the number germinating was recorded each morning and the plants removed.

Results and Discussion

Although the moisture from treating soybean seed caused the seed coat to split and sometimes slip, germination in most cases was not effected and in all but treatment 6 it was enhanced (Table 6).

TABLE 6. Percent germination from seven treatments of soybean seeds.

Treatment	Average (range) of four replications	Totals
1. Untreated seeds	61.75 (51-83)	247
2. Seeds with latex and water	83.50 (81-86)	334
3. Seeds with 0.5% DRC-736 latex and water	81.00 (79-86)	324
4. Seeds with alcohol, acetone, and latex	64.75 (52-75)	269
5. Seeds with 0.5% DRC-736 alcohol, acetone, and latex	78.25 (72-82)	313
6. Seeds with 0.2% DRC-736 alcohol, acetone, and latex	57.50 (50-67)	230
7. Seeds with 3% DRC-736 alcohol, acetone, and latex	80.25 (78-82)	321

Survival of DRC-736 Treated Soybean Plants (ICA-Taroa)

Procedures

A plot of approximately 2,000 sq m was planted with soybeans treated with 0.0, 0.25, and 0.50% levels of DRC-736 in a water slurry. Each treatment had either four or eight rows about 50 m long. Each trial had three replications. From the seventh day after planting and for 5 consecutive days, germinated plants were counted in 4-m randomly selected plots. Also, a 10% sample of plants per meter was taken 20 days after germination.

Results and Discussion

The results seem to indicate better survival for untreated seeds because the higher concentration of DRC-736 produced fewer plants per meter (Table 7). This test will be repeated and a statistical analysis run. A 10% sample from the test field 20 days after planting gave an average of 9.7 (range 3.0-15.4) plants per meter when all treatments were lumped.

TABLE 7. Plant survival from DRC-736 treated soybean seed 7-12 days after planting.

Treatment level	Average (and range) of plants per meter from three replications
0.00%	11.42 (8.25-15.00)
0.25%	7.82 (5.00-10.50)
0.50%	6.02 (3.50-12.00)

Yield of DRC-736 Treated Soybean-seed Plants (ICA-Taroa)

Procedures

The plants used to test the survival of DRC-736 treated soybean-seed plants were harvested and the seeds collected.

Results and Discussion

This data has not been analyzed and cannot be reported at this time.

Dove Damage Appraisal Studies (ICA-L111)

Procedures

Soybeans were planted in 1/2-acre plots and different types of dove damage to soybean cotyledons were simulated. Cotyledons were cut with scissors and the type damage is shown in Table 8.

Plants were cut the second and third day after germination, and all emerging plants were damaged. The treatments were made in four replications in random blocks.

Results and Discussion

The day after the soybeans began to emerge another damage problem was discovered. Rats (*Rattus rattus*) were observed in the test plots and

TABLE 8. Soybean plant average production (range where possible) in response to different levels of stimulated dove damage to cotyledons.

Type of cut	Height 20 days post planting	Plants per meter	Pods per plant	Seeds per pod	Seeds per plant	Seeds per meter
None	65.7 (57.9-69.9)	12.0 (10.6-13.5)	38.8	2.4	93.1	1,117.2
1/2 of one cotyledon	61.9 (43.2-68.5)	12.2 (10.5-13.0)	38.2	2.5	95.5	1,165.1
1/2 of both cotyledons	63.1 (61.0-68.4	11.1 (10.1-12.5)	40.3	2.2	88.7	984.6
1 cotyledon	58.9 (44.3-69.4)	10.6 (7.9-13.1)	33.4	2.2	73.5	779.1
2 cotyledons	65.9 (62.7-67.5)	11.4 (8.1-13.5)	35.5	1.9	67.5	769.5

were apparently eating soybean cotyledons and parts. Many of the cotyledons were damaged in areas where rats were observed or trapped. But, the test results indicated that cutting off both cotyledons (greatest damage) resulted in the tallest plants, and the poorest seed yield. Cutting off one-half of one cotyledon (least damage) produced the most plants and the most seeds per plant, hence the greatest seed production. With the exception of treatment 2, seed yield at maturity was decreased by increased damage to cotyledons at germination (Table 8). A small amount of dove damage, as in treatment 2, may stimulate the plants and increase bean production.

A similar study was conducted several years ago at ICA and parallel results were obtained although seed yield was not noted. All of our studies point out that seed yield data is necessary for evaluation of dove damage because many factors cause plant losses in soybeans.

From our food habits studies, plant material similar to treatments 2 and 3 have not been found in dove crops, indicating that plants so damaged probably have been the result of rodent, insect, or other type of damage. The test will be repeated and treatments 2 and 3 will not be included. Simulated damage will commence the first day of germination and continue for 3 or more days to eliminate the possibility that late damage initiation may produce little plant influence.

Evaluation of dove damage to soybeans is necessary to determine the birds' economic effect, and to evaluate results of control treatments. But, the actual damage caused by eared doves to soybean plantings has never been completely understood, and will be very difficult to evaluate. Early reports indicated that the doves preferred cotyledons and would not eat soybean seeds. In our cage tests, however, doves refused to eat soybean cotyledons, but ate soybeans readily. Many times dove damage is indistinguishable from other types of damage (insect, mechanical, etc.).

Poor stands of soybeans are often attributed to dove depredation whether doves have been seen or not. Occasionally the poor stands can be traced to bad seed, poor equipment, planting depth, condition of the soil, moisture, and other factors besides eared doves..

We believe that bird scaring personnel (pajareros) may also cause damage by trampling soybean plants during periods of dove invasion, and there is a possibility that bird scarers may attract birds to fields while germination is occurring.

Field observations and food habits indicate that doves begin feeding on weed seeds and collecting grit in fields when the land is being

prepared for planting. Doves will continue to feed in fields, if food in the fields is adequate, and the population will build up and consume cotyledons during germination and emergence. Therefore, in problem areas, control in any form should start sometime before planting to eliminate any population buildup. It is common practice, however, to wait until the day of germination to introduce control measures. Planting before the rainy season starts has also been quite effective in reducing the doves feeding in newly planted soybean fields.

Shiny Cowbird Damage in Colombia

Introduction

The shiny cowbird (*Molothrus bonariensis*) is a pest in corn, rice, and sorghum, and has caused serious damage to experimental and commercial plantings. Evidence indicates that the bird may cause one of the more serious damage problems in Colombia.

Ripening Corn

Procedures

In October two experimental plantings of corn on the CIAT experimental farm near Palmira were ground baited with cracked corn. The bait was treated with 2% DRC-1327, diluted with 50 parts untreated cracked corn, and applied at approximately 1 lb. per 12 hectares.

Results and Discussion

The ground baiting was successful in frightening shiny cowbirds from experimental plantings. In one 2-hectare field, damage was quite severe before treatment and one treatment discouraged the birds for 3 days. In a 1-hectare sweetcorn plot, shiny cowbirds were frightened from the area before any damage was experienced because the birds were feeding on weed seeds in the plot.

The ground baiting was successful in frightening shiny cowbirds, but resulted in the death of several ground doves (*Columbina talpacoti*). Further tests could not be conducted because of an outbreak of hoof and mouth disease, and quarantine of the area. Proximate trials will be conducted using 1% DRC-1327 in an attempt to reduce the hazards to ground doves.

Sprouting Corn

Procedures

After a report that shiny cowbirds were pulling corn sprouts on the CIAT farm, arrangements were made to replant with 0.5% DRC-736 (water slurry) treated corn seed in the same area. Another plot was to be planted with untreated seed.

Results and Discussion

The test never materialized, but future tests are planned.

Migratory Bird Damage in Colombia

Introduction

The dickcissel and the bobolink (Dolichonyx oryzivorus) are implicated in rice and sorghum damage in Colombia, Venezuela, Costa Rica, Mexico, and Nicaragua. Efforts to locate concentrations and damage in Colombia have been fruitless. Reports of bird damage to rice near the north coast and in the plains have been received but no species identification has been possible.

Procedures

During a January trip to the Plains of Colombia, only two rice fields were located and no dickcissels were seen. Past reports indicated dickcissel damage to maturing rice began in February; however, we were told that the majority of the rice would be planted in March at the time of usual damage. If a damage situation had been located, control with DRC-1327 ground baiting would have been attempted.

Results and Discussion

According to local descriptions of the bird causing most of the damage to rice, it may not be the dickcissel. ICA personnel near Villavicencio were contacted and they were to inform us when damage commenced in March. No contact or report of damage was received.

Heavy bird damage was also reported to ripening sorghum in January on the Caribbean Coast near Guacamayal. The report stated that many birds were in the area and it was impossible to drive them out of maturing sorghum fields. The species of bird was unknown, but according to the description, it may not have been dickcissel.

We have sent requests to experiment stations on the Plains and North Coast asking for prompt damage reports in order to investigate the problems. The one reply from Guacamayal came too late.

Psittacidae Damage in Colombia

Introduction

Members of the parrot family (Psittacidae) present problems in agriculture throughout the tropics, but station biologists have found only local situations in Colombia where parrots may cause serious damage.

Procedures

During a trip to Monteria in January very few cornfields were located. Those located were beyond the stage necessary for conducting a DRC-1327 ear-spray trial. The corn was hard and there was only slight damage caused by a group of 50 parakeets (Aratinga pertinax) (Fig. 6). In spite of the poor test conditions, some ears were sprayed with DRC-1327 and the field was observed.

Results and Discussion

No affected birds were seen and the results were inconclusive.

Black Vulture Damage in Colombia

Introduction

Approximately 500 black vultures (Coragyps atratus) have caused serious damage at the oil palm plantation, "La Arenosa," near Turbo, Antioquia. Most people believe feeding oil palm fruit is a new vulture habit, but it was previously reported by Haverschmidt (1968).

Fig. 6. Brown-throated parakeets (Aratinga pertinax) collected while damaging mature corn in Monteria.

Measurements of oil palm fruits found in the crops of several specimens along with the estimate of the population could result in daily losses of $150-$200 (U.S.). The majority of the damage occurs while the fruit racimes are on platforms waiting for transportation to an oil extraction plant (Fig. 7). Very little feeding takes place in the trees, although some was observed. Damage takes place year around.

Procedures

We had hoped to run some cage studies with DRC-736 and to see if other techniques of crop protection could be used.

Results and Discussion

Neither the modified Bal-chatri traps, which were used successfully on turkey vultures in Nicaragua, nor mist nets were effective in capturing specimens. The birds were easily frightened, but they moved only a short distance or moved to the next platform and continued feeding. Covering the platforms or using scaring boys would solve the problem, but the owner felt either would be too expensive. Also, if all platforms were covered, the birds might begin to feed on the trees.

In the hope that plantation personnel would later have success in capturing vultures, we left some DRC-736 and explained the procedure for carrying on a cage study. At the same time we had a meeting with Inderena personnel and asked what Inderena would permit in the form of animal damage control involving black vultures.

No information nor data has been received from either La Arenosa or Inderena.

RESEARCH ACTIVITIES - NICARAGUA

Rodent Damage to Rice in Nicaragua

Introduction

The proper identification of a field pest is important. Many rodent species appear similar but exhibit different behavior and different responses to control measures. In order to identify a rodent causing rice damage in Nicaragua, we sent specimens to the Smithsonian Institution.

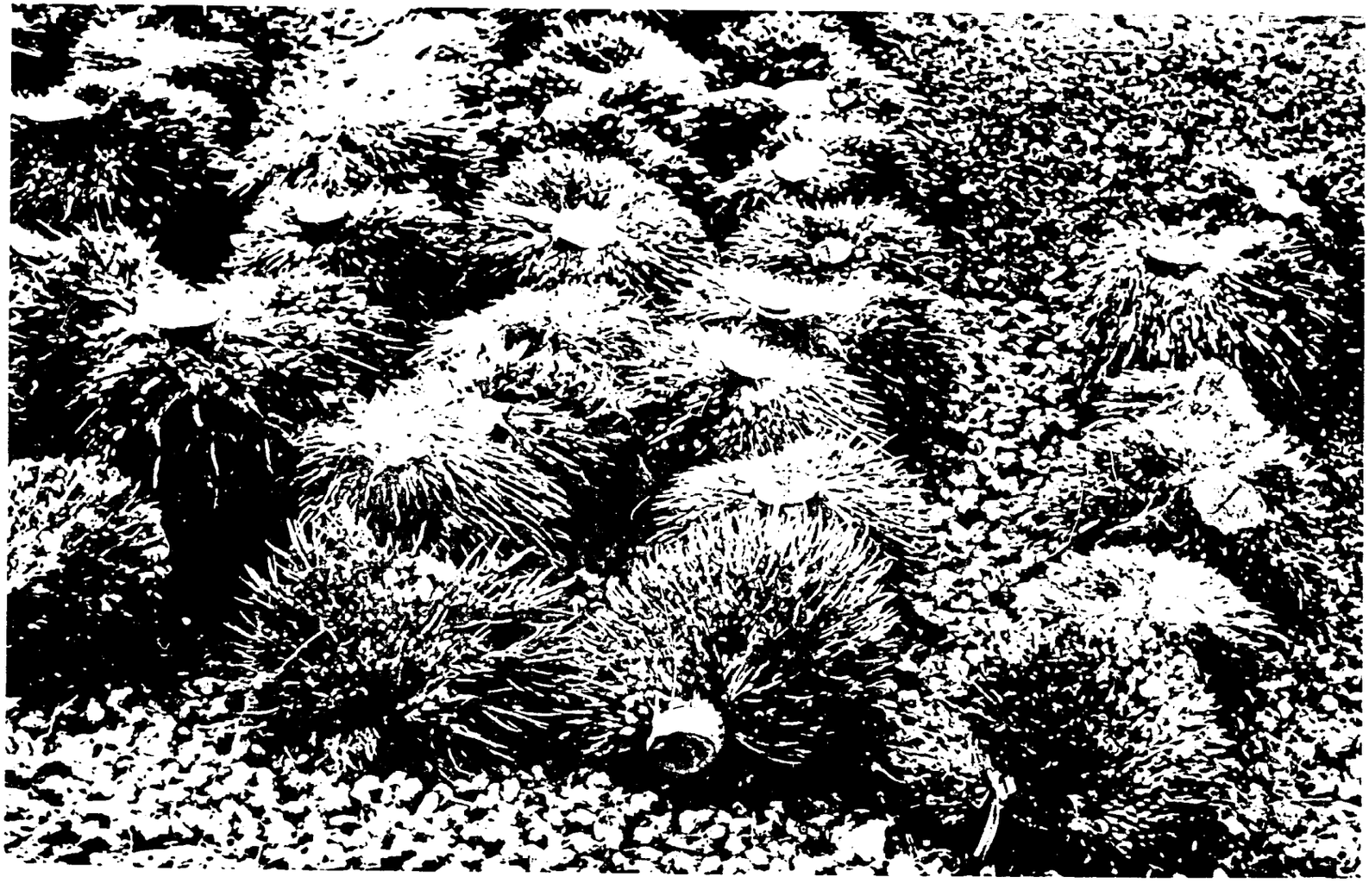

Fig. 7. A platform of oil palm racimes showing fruit damage by black vultures (Coragyps atratus).

Procedures

Animals were captured live in the rice fields, killed by carbon monoxide poisoning, and prepared as study specimens (Setzer, 1968). They were packed and shipped to the Smithsonian Institution, Washington 25, D.C. with a letter requesting identification.

Results and Discussion

Dr. Ronald H. Pine, Curator, Mammal Identification Service, identified the specimens as *Sigmodon hispidus*. Subspecies identification was not made.

Population Comparison of Different Habitat Types

Introduction

This study was done to determine which habitats support the most rodents. The information is needed to determine where applications of the toxicant might be the most effective in reducing populations.

Procedures

A series of traplines (50 traps each at 10-m intervals) were set for one night in five habitat types. Victor 4-way rat traps with peanut butter and rolled oats as bait were used. The sex of animals captured was recorded to obtain an estimate of sex ratio, but no attempt was made to estimate age class.

Results and Discussion

A total of 400 trap nights yielded 21 animals for 7% trap success. In comparison, the trap success in the same area in 1971 was 51%. The highest trap success in a single habitat type this year was 11%, while in 1971 it was 68% (Table 9). This year we found an approximate sex ratio of 1.44 males per female. In 1971 the ratio was 1.27 females per male.

Insufficient data precluded reliable inferences; however, the results may have indicated that the extremely high populations of early 1971 were the result of a population irruption. As far as we know there are

TABLE 9. Cotton rats captured in different habitat types on two ranches in Nicaragua (February 5-16, 1972) and comparison to 1971 data.

Habitat description	Number captured			Percent trap success		
	1971	1972	Average	1971	1972	Average
Barren field, harvested and burned 2-3 months before trapping	41 (20M - 21F)	No sample	No average	68	No sample	No average
Plowed field	4 (1M - 3F)	3 (2M - 1F)	3.5 (1.5M - 2F)	14	6	10
Recently burned field	No sample	1 (1M - 0F)	No average	No sample	2	No average
Irrigated, growing rice	20 (8M - 12F)	2 (1M - 1F)	11 (4.5M - 6.5F)	66	4	35
Harvested rice field with stubble remaining	No sample	22 (8M - 9F) 5 not recorded	No average	No sample	11	No average
Woods, scrub and small trees, dry grass, cactus	12 (4M - 5F) 3 not recorded	0 (0M - 0F)	6 (2M - 2.5F)	40	0	20

no records available on past occurrences of this nature in Nicaragua. We cannot, therefore, state that this was an unusual phenomenon or a fairly common occurrence. The apparent extreme drop in population density may be a result of disease or some other factor brought on by overcrowding. It has been pointed out (Elton, 1942) that periods of great mammal abundance are not infrequently followed by epidemic. Further investigations will be continued in Nicaragua in 1973.

Field Baiting Studies

Introduction

Good control was achieved in initial field trials in 1971 with zinc phosphide baits. To obtain further information on when, where, and how to apply the toxicant to achieve the best results, another zinc phosphide baiting trial was run.

Procedures

A recently harvested rice field of approximately 57.8 acres was tested because it yielded the highest trap success (20%) in earlier population studies. A considerable amount of rice stubble, weeds, and spillage (rice heads and seeds) covered the area. The field was treated with a 2% (by weight) bait formulation of 94% active zinc phosphide in corn oil on broken rice. No correction factor was applied to account for the 6% inactive ingredients. Approximately 9.5 lb. of bait were applied by hand in bait spots of about 10 g each. Bait was placed along the major dike surrounding the field at 5-m intervals, and along the intermediate dikes within the field at 10-m intervals.

Results and Discussion

Pretreatment trapping gave 20% trap success, while posttreatment trapping gave 15% trap success, indicating only a 5% difference. This low figure might be attributable to any or a combination of several factors.

1. Because of spillage in the field, rats may have ignored the bait in favor of the plentiful, easily available food.

2. A field immediately south of the test was burned the day after baiting. Most (12) of the 16 animals captured posttreatment were taken in the half of the field adjacent to the burn. These rats may have been driven to the test plot by the fire.

3. The test site was dry and rats could range freely. Baiting was done on dikes and dike edges; most rats may not have encountered it.

4. The thick stubble and heavy ground cover may also have reduced rat exposure to the bait.

5. The low treatment rate (0.16 lb./acre) may have been insufficient. This rate was unintentional. Baiting was intended to be the same as the previous year, when approximately 1 lb./acre was used, but erroneous information on field size resulted in a false application rate. The test will be repeated before conclusions are drawn. The results, however, did indicate that baiting a stubble field is not a good practice, and that baiting at other times and under different field conditions would be more effective.

Hazards of ZnP to Birds

Introduction

One of the primary concerns with toxic baits is the effect they may have on animals other than the target species. Seed-eating birds which might pick up the treated rice or other bait material intended for rodents are especially vulnerable. This study was an attempt to determine if hazards to birds from zinc phosphide bait exist.

Procedures

Ruddy ground doves (*Columbigallina talpacoti*) were force-fed hulled rice treated with zinc phosphide at the rate of 2% by weight. Each bait contained 8.4 mg/kg, based on average bird weight.

Results and Discussion

Seven birds were treated, at one level each, at levels ranging from 1 to 30 seeds. All except those dosed with one or two seeds on 11 February died. The test was repeated on 14 February using the bait prepared on 11 February. No deaths occurred, except at the seven-seed level. On 15 February two more birds were dosed and survived (Table 10).

The results were erratic. The toxicity of the bait may have deteriorated, but this is doubtful because ZnP does not deteriorate at a rapid rate even under field conditions (Rudd and Genelly, 1956). Studies at the Philippine Rodent Research Center indicated that zinc phosphide bait remained toxic

TABLE 10. Toxicity of ZnP-treated rice (2%) administered orally to the ruddy ground dove (Columbigallina talpacoti) in 1972.

Date	Bird No.	Bird Sex	Bird Weight (grams)	Dosage level x number of seeds	Results: approximate time of death post-treatment
February 11	1	F	42.6	8.4 mg/kg x 1	Survived
	2	M	43.3	2	Survived
	3	F	36.4	3	Dead, 24-48 hrs
	4	M	48.2	4	Dead, 24-48 hrs
	5	F	40.0	5	Dead, 24-48 hrs
	6	M	42.3	10	Dead, 3 hrs +
	7	F	39.2	30	Dead, 3 hrs +
February 14	1*	F	43.8	8.4 mg/kg x 1	Survived
	2*	M	41.3	2	Survived
	8	F	43.0	2	Survived
	9	M	44.0	3	Survived
	10	F	42.2	4	Survived
	11	F	41.7	5	Survived
	12	F	42.2	7	Dead, 24-48 hrs
	13	M	42.8	10	Regurgitated 7 seeds
	14	M	40.0	2	Survived
February 15	15	M	46.2	8.4 mg/kg x 6	Survived
	16	M	41.2	10	Survived

* Same birds treated February 11, 1972.

for 3 days after exposure to 1.34 inches of rain. Not until the bait had been exposed for 6 days and 3.5 inches of rain did test animals survive more than two feedings. The vertebrate pest control handbook published by the California Department of Agriculture (Anonymous, 1968) states that grain baits containing zinc phosphide remain toxic for months in protected locations, and the bait we used was well protected in the laboratory.

Observations were made for several days following baiting of the field described in the previous section, to see if seed-eating birds frequented the field and picked up bait. None were observed. The suggestion was made that there would be little danger to birds because the bait is charcoal-grey colored.

Secondary Hazards of ZnP to Raptors

Introduction

Secondary poisoning of nontarget species should be avoided. The following study was done to attempt to assess possible danger of ZnP-killed rats to raptorial birds.

Procedures

A modified Bal-chatri trap was used in attempts to capture turkey vultures (*Cathartes aura*) and crested caracaras (*Polyborus plancus*). Two dead rats were used as bait, and the traps were placed on the ground in areas frequented by the birds.

Captured birds were placed in circular cages, of 1" x 1" welded wire, 1-m high with 28-inch diameters. Captured birds were first fed unpoisoned freshly killed rats to determine if they would feed in captivity. Nonfeeders were not used in the study.

Ricefield rats were held in cages and allowed to free-feed on 2% (by weight) zinc phosphide-treated rice. The freshly killed rats were then offered to test birds.

Results and Discussion

No caracaras were captured, but four turkey vultures were taken. One vulture was a nonfeeder and was not used.

Vulture No. 2 accepted nonpoisoned rats on 16 February. On 17 February, four zinc phosphide-poisoned rats were placed in the cage. The average rat weight was 77 g, and they collectively consumed 5.5 g of bait; approximately 1.4 g each. The vulture consumed everything but the head, feet, and skin of the back and sides. On 18 February the test animal consumed four more rats, averaging 92.2 g each, that had consumed approximately 1 g of bait each. The vulture was found dead the morning of 21 February.

Vulture No. 3, although a nonfeeder, was force-fed a gelatin capsule containing approximately 0.86 g of 94% active zinc phosphide on 21 February. The bird was dead the following morning.

On 18 February vulture No. 4 was fed four poisoned rats averaging 92.2 g that had consumed approximately 1 g of bait each. Subsequent feedings

consisted of fresh beef or pork. The bird survived a 7-day observation period; however, it grew weak as time passed.

Several factors made it difficult to make definite conclusions from the study. The cage facilities were inadequate and excessively confining. The birds had no perches and were forced to spend all the time on the ground. There was insufficient space for them to walk except to turn around. All the birds appeared to have difficulty standing or walking after a day or two in the cage, and they could not extend their wings to any degree. It is believed that lack of exercise over an extended period had a debilitating effect. It was thought that the birds would obtain all the moisture they required from food, and free water was not available. However, the actions of vulture No. 4, when offered water, seem to indicate that water was necessary.

Rudd and Genelly (1956), in their discussion on zinc phosphide, cite Przygodda (1951) that raptors do not suffer from eating poisoned mice. The California vertebrate pest control handbook (Anonymous, 1968) states that secondary hazards do exist, and that dogs, cats, and other animals can die from eating zinc phosphide-poisoned rodents, but secondary hazards to raptors specifically are not mentioned. Further tests, similar to ours, should be carried out; but, better facilities and husbandry techniques to insure the health of the test animals must be developed.

Long-term Field Studies

Introduction

The accumulation of information pertaining to ricefield rodent problems, such as damage measurements, population densities, fluctuations, reproductive patterns, etc., necessarily involve efforts over extended periods. Limitations of time, travel, and other obligations preclude personnel from the Denver Center or this field station from personally conducting long-term investigations. Assistance from local personnel is required, and some have participated in our studies.

Procedures

The personnel from the Banco National de Nicaragua who have participated in the studies during the past 2 years now have sufficient experience to establish studies and collect data. Several tentative programs were discussed for the current and coming year which include:

1. Damage surveys are needed throughout affected areas in order to detect benefits, or lack of same, resulting from damage control programs.

2. Measurements of rodent populations and the effects of the populations on rice production in Nicaragua are needed.

3. Field baiting studies on the effects of zinc phosphide baiting under different conditions and at various times of the year are needed. Comparisons of current control techniques and materials are also desirable.

Results and Discussion

All current research in Nicaragua has ended because of a severe earthquake in Managua.

Dickcissels and Rice in Nicaragua

Introduction

Major emphasis of research in Nicaragua has been directed toward rodent damage to rice; but, dickcissels periodically cause severe damage as well. The damage is so severe that many rice growers now plant and harvest during periods when the birds are not present. A certain degree of risk is involved in this practice because of possible unfavorable weather conditions at critical periods. This study was done to gain more information on dickcissel problems prior to initiating field trials of control methods.

Procedures

Detailed observations were made throughout the major rice-growing regions of the country in an attempt to answer the following questions:

1. When and where does damage begin and end?

2. What is the stage of development of rice being damaged?

3. What are the roosting and feeding patterns of the birds?

4. What numbers of birds are present?

In addition, a small ground-baiting trial was run with DRC-1327 treated rice at 2% (by weight). One pound of treated rice was mixed with 10 lb. of untreated rice, and 20 lb. of bait were hand-broadcast over two small sections of a harvested rice field where birds were observed feeding. Chemical control currently used in Nicaragua involves Endrin-treated rice and Azodrin sprayed from aircraft.

Results and Discussion

The first dickcissels of the southward migration generally appear the last week of August. The greatest numbers are present the first half of September, and then numbers decline, with most of the birds gone by the first of October. If food is plentiful, small groups tend to remain into November and December. During the northward migration, dickcissels first appear the last week of February and reach peak numbers by March. Generally, all have passed through by April 15.

Apparently, mature rice suffers the greatest damage just prior to harvest, but some damage also occurs to emerging plants in fields. Feeding birds show no preference for the edges or the center of fields, but range throughout. Major feeding takes place early in the morning and late in the afternoon. The birds apparently roost at night and during the hot part of the day in woodlands bordering rice fields, and use definite flightlines to and from roosting sites.

The birds failed to return to the baited site on the day of our test. The site was checked again the following morning and all birds had left the area; however, it was not determined if they left on their own, or because of the repellent bait. Further field baiting trials were planned for 1973.

PUBLICATIONS

The following articles were published and distributed as indicated:

Londono, Jose F. 1972. Las torcazas, problemas en su cultivo. Algunos metodos de control. Instituto Colombiano Agropecuario, NOTISOYA, No. 2, 1 p.

Woronecki, Paul P., Jose Fernando Londono, Donald J. Elias, Danilo Valencia, Everardo Vogel, and Rene Bojorge. 1972. Investigaciones sobre el control de danos causados por los vertebrados en la agricultura, Informe Anual 1971. (Spanish version of Colombia Station 1971 Annual Report distributed in mimeograph form to more than 300 persons in Colombia, including agronomists of both government and private industry, agriculturists, and other interested persons.)

CONFERENCES AND PRESENTATIONS

On 4 June, approximately 300 persons toured the project facilities. A brief presentation was made by Danilo Valencia and Fernando Londono. The visit was part of a program sponsored by the ICA Experiment Station celebrating the "Dia Nacional del Campesino."

On 8 August, Donald J. Elias gave a talk on rodent control in rice and Danilo Valencia gave a talk on bird damage control in rice to a group of 22 Brazilian agronomists attending a course in rice production at the Centro International de Agricultura Tropical (CIAT). Field demonstrations covering different types of pest control for rice followed the discussions.

On 7 October, Paul P. Woronecki and Danilo Valencia attended a rice seminar in Ibaque sponsored by Fedearroz. Valencia gave a talk on vertebrate damage problems and control in rice (Fig. 1).

On 27 October, the project hosted a program for the experiment station staff by a representative of the Bayer Company. A movie on rat problems and control was featured.

On 29 November, project personnel presented a brief talk to participants of the XII International Symposium of Basic Ecology.

On 5 December, Paul P. Woronecki and Donald J. Elias attended a meeting at the Department of National Planning (Departamento Nacional de Planeacion, Unidad de Cooperacion Tecnica Internacional) in Bogota. The purpose of the meeting was to give the Colombian officials an opportunity

to learn in detail about some of the problems encountered by foreign technicians in Colombia, and to hear some of the recommendations for alleviating these problems. Other groups represented included the University of Utah, FAO, and TAHAL (a private consulting firm from Israel).

LITERATURE CITED

Anonymous. 1968. Vertebrate pest control handbook. Weed and Vertebrate Pest Control, Division of Plant Industry. California Department of Agriculture.

Elton, C. 1942. Voles, mice, and lemmings. Problems in population dynamics. Clarendon Press, Oxford.

Haverschmidt, F. 1968. Birds of Surinam. Livingston Publishing Company, Wynnewood, Pennsylvania.

Johnson, A. W. 1967. The birds of Chile. Platt Establecimientos Graficos S. A., Buenos Aires, Argentina. (2 vols.)

Olivares, A. 1970. Effects of the environmental changes on the avifauna of the Republic of Colombia. in The Avifauna of Northern Latin America: A Symposium Held at the Smithsonian Institution, Smithsonian Contributions to Zoology, Number 26.

Przygodda, W. 1951. Feldmausbekämpfung und Vogelwelt. Deutsche Vogelwelt, No. 72.

Rudd, R. L., and R. E. Genelly. 1956. Pesticides: their use and toxicity in relation to wildlife. California Department of Fish and Game, Game Bulletin No. 7.

Sanchez, A., and E. Mean. 1971. El cultivo del cocotero. Instituto Colombiano Agropecuario, Regional 5, Boletin de Divulgacion No. 1.

Setzer, H. W. 1968. Directions for preserving mammals for museum study. The Smithsonian Institution, Washington 25, D.C., Information Leaflet 380.

Smith, R. W. 1967. The control of rats in coconuts using rat blocks. Oleagineaux, No. 22.

Strecker, R. L. 1962. Economic Relations, coconut groves. in Pacific island rat ecology. [Ed.] Storer, T. I. and Bernice P. Bishop. Mus. Bull. No. 225.

Thompson, R. L., and F. Agudelo. 1969. Crop production program, subproject: bird control. Centro Internacional de Agricultura Tropical, Unpub. Rept.