

PREHARVEST CORN LOSSES TO VERTEBRATE PESTS IN HAITI¹

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ABSTRACT:

Vertebrate pest damage to maturing corn was compared between two major corn-producing areas in Haiti. The damage was caused by Norway rats (*Rattus norvegicus*), African village weavers (*Ploceus cucullatus*), and Hispaniolan woodpeckers (*Melanerpes striatus*). More corn was consumed by rats, but secondary losses from disease and insects following woodpecker damage place the Hispaniolan woodpecker as the mayor vertebrate pest in maturing corn in Haiti. Some control strategies are discussed.

Increasing food production is one of the most important challenges facing mankind. In some developing countries, the disparity between available food and population is acute, despite the fact that about one-half of the world's population is actively engaged in agriculture. The reasons for these disparities are complex and involve agricultural practices, marketing, storage, and pests. Vertebrate pests, primarily birds and rodents, are certainly important factors.

Corn is the major cash crop in Haiti and is grown in 10 of the 15 agronomic districts in the country. In 1985, Haiti produced 200,000 t of corn compared with 150,000 t of millet and 150,000 t of rice (1)

Farmers were asked to identify vertebrate pests that were attacking their corn fields. The following pest species were identified in the order of severity of damage: Madame Saga, rats, feral dogs, and woodpeckers. Madame Saga is the local name for the African village weaver (*Ploceus cucullatus*), rats are Norway rats (*Rattus norvegicus*), and woodpeckers are Hispaniolan woodpeckers (*Melanerpes striatus*).

Farmer surveys are often biased; therefore, to document which are the major vertebrate pests, we compared vertebrate pest

damage to maturing corn in two major corn-producing areas of Haiti. The two agronomic districts selected were Port-au-Prince and Les Cayes. These areas produce 23% of the corn grown in Haiti. Documenting which vertebrate pests are causing damage would influence which control strategies should be applied.

MATERIALS AND METHODS

Thirteen fields were sampled in Port-au-Prince and 20 fields in Les Cayes. Five random transects were selected in each field. On each transect, 10 hills of corn were randomly selected for the study (i.e., 50 hills per field). All ears were collected from each plant in each hill.

Damage was determined and categorized as rat, Madame Saga, Hispaniolan woodpecker, or feral dog damage. Damage measurements were made on every ear in the samples (1,573 ears from Port-au-Prince and 2,366 ears from Les Cayes). Measurements taken on each ear included length, number of rows of kernels, and length within each row that had been damaged by each pest species. This method allowed for an estimate to be made of the proportion of the surface area damaged on

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each ear. Using previously developed regression formulae (Engelman et al. 1985), the weight loss on each ear to each depredating species was estimated, allowing an estimate of the proportion lost by weight to be calculated. Area, field, hill, and plant number were recorded for each ear. Comparisons of damage levels (proportion surface area or weight loss) were then made among areas and depredating species using a two-factor repeated measures analysis of variance (Winer 1971).

RESULTS

Dog damage was not found in any sample and was, therefore, excluded from analyses. Highly significant results were obtained in the area-by-species interaction in the two-factor repeated measures analyses of variance (ANOVA). Table 1 presents the cell means in the area-by-species interaction for percent surface area loss and percent weight loss.

Table 1. Damage percentages from each species in each area.

Area	Species	Surface area lost (%)	Weight lost (%)
Les Cayes	Madame Saga	1.5	1.3
	Norway rat	0.3	0.3
	Hispaniolan woodpecker	4.1	3.6
Port-au-Prince	Madame Saga	5.9	5.3
	Norway rat	5.8	5.7
	Hispaniolan woodpecker	2.1	1.9

Using Duncan's multiple range test to locate differences among these means, we found that woodpecker damage was not significantly different between Les Cayes and Port-au-Prince, although the mean damage levels were nearly twice as high in Les Cayes. However, damage by Madame Sage and Norway rats was significantly higher in Port-au-Prince than in Les Cayes.

After observing the above results, we were interested in examining if the extent of damage on an ear of corn is affected by the area where it was grown. Another twofactor repeated measures ANOVA was performed using only those ears that had been damaged. These analyses would indicate the amount of

damage that can be expected, given that there is damage. Unlike the first analyses, there was no significant area-by-species interaction. This implied that mean damage levels for individual attacks within each species are similar between the two areas, although different population sizes of animal species in each area may result in different overall damage levels between areas. The depredating species were found to be significantly different in levels of individual attacks on ears of corn. Table 2 presents the mean percentage lost by species after an attack.

Table 2. Damage percentages for each species after an attack.

Species	Surface area lost (%)	Weight lost (%)
Madame Saga	14.4	12.9
Norway rat	27.7	26.7
Hispaniolan woodpecker	11.4	10.3

These results indicate that rat damage is approximately twice as high as damage caused by Madame Saga and two and one-half times as high as damage caused by woodpeckers.

However, as seen in the first analyses, overall damage levels due to rats are roughly the same as for Madame Saga in the Port-au-Prince area and one-fourth to one-third of those for Madame Saga in the Les Cayes area. This implies that when rats attack ears of corn, they damage at higher levels than Madame Saga, but attacks by this species are more frequent.

To confirm that bird (Madame Saga and woodpeckers) attacks are more frequent than attacks by rats, we calculated for each species the percentage of ears that received measurable damage. These results are given in Table 3.

Table 3. Percentage of ears damaged by each species.

Species	Les Cayes	Port-au-Prince
Madame Saga	15.4	33.2
Norway rat	0.8	13.9
Hispaniolan woodpecker	40.4	14.4
Any animal	56.1	56.3

As expected, bird-damaged ears were much more common than rat-damaged ears. The high frequency of damage by woodpeckers is interesting. This potential level of woodpecker damage is not as evident in the previous analyses because woodpeckers do not destroy a great amount when they attack. However, any attack can expose the ear to invasion by insects or microbes.

DISCUSSION

Preharvest corn losses to vertebrate pests in Haiti can be compared in several ways.

Comparison of total surface area lost: Total surface area lost to vertebrate pests is 5.9% for Les Cayes and 13.8% for Port-au-Prince, or an average of 9.85%. This figure is extremely high and in sharp contrast to those for the states of Ohio, Kentucky, and Tennessee in the United States, where average losses to vertebrate pests in maturing corn are less than 1.0% by surface area (Stickley et al. 1979). Comparing surface area lost by species (Table 1), Norway rats and Madame Saga cause significantly more damage than Hispaniolan woodpeckers.

Comparison of percentages of ears damaged: Data for the number of ears damaged by species are almost the reverse when compared with surface area lost (Table 3). Hispaniolan woodpeckers drilled holes in 40.4% of the samples from Les Cayes and in 14.4% of the samples from Port-au-Prince. The impact of woodpecker drilling is not the actual surface area lost, but secondary losses from disease and insects following the woodpecker damage. Fungi and water cause most of the secondary losses. Fungi will completely destroy an ear of corn, and water allows the corn kernels to germinate prior to harvest. If the samples taken from Les Cayes and Port-au-Prince were grown during the rainy season, then one could expect losses due to woodpeckers to be 40.4% and 14.4% of the total yield from both areas.

CONTROL STRATEGIES

One of the objectives of this study was to document which vertebrate pests were cau-

sing damage to determine control strategies.

Norway rats: Control of Norway rats is more essential for Port-au-Prince than for Les Cayes. A sustained baiting program using anti-coagulant rodenticides for maturing corn was developed in the Philippines (Benigno et al 1976). This baiting program was evaluated in Haiti and preharvest losses to rodents were minimal; the proportion lost overall was 0.5%, with a standard error of 0.1% (Engeman et al 1985).

Madame Saga: This species is an important vertebrate pest in both study areas, but unfortunately no effective control method is known. Trimethacarb, an insecticidal carbamate, has effectively repelled several species of birds from maturing crops throughout the world. In Haiti, trimethacarb sprayed on ripening sorghum did not repel Madame Saga or yellow-faced grassquits (*Tiaris olivacea*) from the treated fields (Bruggers et al 1984).

Hispaniolan woodpecker: Preliminary results indicate that this major vertebrate pest can be repelled from maturing corn by a color cue. A study was conducted in Israel, where Syrian woodpeckers (*Dendrocopos syriacus*) are a serious problem damaging black plastic irrigation pipes. Yellow-painted pipes had a deterrent effect on the woodpeckers; no holes were found in the yellow pipes, while damage to the black control pipes followed the regular annual pattern (Barnea and Yom-Tov 1984).

In 1983, woodpecker damage was measured in five experimental plots at Damien, Haiti. Damage (expressed as the percentage of ears damaged) ranged from 32.8% to 56.7%. During the next growing season, blaze-orange plastic strips (Saflag[®]), 5 x 20 cm, were split at one end and attached onto the tip of young corn ears when woodpeckers first began damaging fields. Strips were only placed on about 7% of the ears, but woodpecker damage was effectively reduced to 4.7% and 3.8% in the protected experimental plots. Further evaluations of this control technique need to be made (Denver Wildlife Research Center 1984).

CONCLUSION

Peasant farmers constitute more than 80% of the Haitian population. Corn is a subsistence crop primarily produced for human

¹ Reference to trade names does not imply U.S. Government endorsement.

consumption. Losses to vertebrate pests are greatly reducing the availability of food for Haitian farm families. Therefore, it is impor-

tant that farmers and researchers work together to reduce losses to agricultural crops.

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REFERENCES

- BARNEA, A. and Y. YOM-TOV. 1984. A method to deter Syrian woodpeckers from drilling holes in plastic irrigation pipes. *Crop Prot.* 3 (1): 35-39.
- BENIGNO, E.A., R.A. REIDINGER, J.L. LIBAY, and F.F. SANCHEZ. 1976. Sustained baiting with anticoagulant rodenticides in corn fields and assessment of rat damage. *Proc. 7th National Pest Control Conf., Los Baños, Philippines.* 7: 146.
- BRUGGERS, R.L., P. SULTANA, J.E. BROOKS, L.A. FIEDLER, M. RIMPEL, S. MANIKOWSKI, N. SHIVANARAYAN, N. SANTHAIAH, and I. OKUNO. 1984. Preliminary investigations of the effectiveness of trimethacarb as a bird repellent in developing countries. *Proc. 11th Vertebr. Pest Conf.* 11: 192-203.
- DENVER WILDLIFE RESEARCH CENTER. Vertebrate Damage Control Research in Agriculture. Annual Report 1984. G.C. Mitchell (ed.). 73 pp.
- ENGEMAN, R.M., J.-P. SAMEDY, M.S. BORNSTEIN, and G. CLAY MITCHELL. 1985. A comparison of bird damage among eleven varieties of corn in Haiti. *J. Agric. Univ. Puerto Rico* 69 (3): 291-295.
- STICKLEY, A.R., Jr., D.L. OTIS, and D.T. PALMER. 1979. Evaluation and results of a survey of blackbird and mammal damage to mature field corn over a large (three-state) area. *Vertebrate Pest Control and Management Materials.* ASTM STP 680, J.R. Beck (ed). American Society for Testing and Materials, pp. 169-177.
- WINER, B.J. 1971. *Statistical Principles in Experimental Design.* McGraw-Hill. 907 pp.