University of Nebraska - Lincoln
DigitalCommons@University of Nebraska - Lincoln

Third Eastern Wildlife Damage Control Conference, 1987 | Eastern Wildlife Damage Control Conferences

10-18-1987

A METHOD FOR ASSESSING BLACKBIRD DAMAGE TO RIPENING RICE

Robert G. Wright
Texas A&M University, College Station, TX

Keith A. Arnold
Texas A&M University, College Station, TX

Michael O. Way
Texas Agricultural Research and Extension Center

Follow this and additional works at: http://digitalcommons.unl.edu/ewdcc3

Part of the Environmental Health and Protection Commons

Wright, Robert G.; Arnold, Keith A.; and Way, Michael O., "A METHOD FOR ASSESSING BLACKBIRD DAMAGE TO RIPENING RICE" (1987). *Third Eastern Wildlife Damage Control Conference, 1987*. Paper 63.
http://digitalcommons.unl.edu/ewdcc3/63

This Article is brought to you for free and open access by the Eastern Wildlife Damage Control Conferences at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Third Eastern Wildlife Damage Control Conference, 1987 by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

A METHOD FOR ASSESSING BLACKBIRD DAMAGE TO RIPENING RICE

by Robert G. Wright[1/], Keith A. Arnold[1/], and Michael O. Way[2/]

ABSTRACT

A method for measuring and mapping the location of blackbird (Icterinae) damage to ripening rice over time was developed and employed in 7 commercial rice fields ranging from 20.6 to 47.4 ha in Matagorda County, Texas, during the 1985 and 1986 growing seasons. Ten evenly-spaced transects were established perpendicular to the longest side of the field and each transect was sampled at pre-determined distances. Transects were subdivided into "edge" (<= 60 m from field border) and "middle" (> 60 m from the field border) strata. The measured percent damage was compared to visual estimates for 3 samplings to assess the accuracy and precision of the latter. Measuring the percent damage to individual panicles appears to be valid, but damage may be underestimated. This sampling method may be useful for assessing the efficacy of current and proposed damage control techniques. Visual estimates were too high at low (< 5%) damage levels and too low at higher (> 5%) levels compared to measured damage.

INTRODUCTION

Blackbirds (Icterinae) have been damaging ripening domestic rice since colonial times (Meanly 1971). Although this damage is insignificant on a regional basis, it is not evenly distributed, and individual producers can suffer catastrophic losses (DeHaven 1971, Meanly 1971). To combat this damage most producers employ a variety of pyrotechnic and auditory scare devices. The efficacy of these control measures is unknown. In order to test the efficacy of current damage control techniques, and to develop new techniques, damage must be accurately assessed. Many millions of dollars are believed to be lost annually from bird depredations on ripening rice worldwide (DeHaven 1971, Meanly 1971, Elliott 1979, Bruggers and Ruelle 1981), yet objective damage assessment methods have only recently been developed (Manikowski 1985). The problem is twofold. First, damage tends to be sporadic and unpredictable. Quantitative assessment is also difficult due to the the large and highly variable number of grains per panicle, the dense plant stand, and the often very large fields (Lefebvre et al. 1983).

Bird damage assessment techniques for row crops employ random selection of rows and distances along each row (DeGrazio et al. 1969, Stickley et al. 1979, Avery and DeHaven 1982, Conover 1984). This is impractical for rice, which is broadcast seeded or drill planted in very close rows. Holler et al. (1982) solved this problem by employing randomly-located transects and sample points to estimate blackbird damage to sprouting rice in Louisiana. However, this method is inadequate for mapping damage within the field because damage is often unpredictable (Meanly 1971, Lefebvre et al. 1983, Manikowski 1985).

The most vulnerable stage of ripening rice also is unknown and may be important. In this paper we report on a technique developed for documenting the amount and location of blackbird damage to ripening rice over time.

We are grateful to R. Corporon, B. Ottis, and M. Ottis for permission to survey their rice fields. J. Engbrock made the initial producer contacts and provided logistical support throughout the study. We thank C. E. Gates for his statistical expertise and T. B. Doerr, H. E. Hunt, and R. D. Slack for reviewing earlier drafts of the manuscript. Funding was provided by the Texas Rice Research Foundation, Texas Agricultural Experiment Station, Texas Ornithological Society, and the Wilson Ornithological Society.

1/Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX 77843.
2/Texas Agricultural Research and Extension Center, Route 7, Box 999, Beaumont, TX 77706.

METHODS

Study Area:

We surveyed 7 ripening commercial rice fields in Matagorda County, Texas during the 1985 and 1986 growing seasons. In Texas, most rice is grown on the Gulf coastal plain and most damage is concentrated in a narrow zone bordering the coastal marshes (Meanly 1971). Fields with a history of heavy depredation pressure were selected in an effort to insure enough damage for method development.

Sample Design:

The need to map damage within the field dictated that a systematic sample design be employed. We modified Holler et al.'s (1982) method, using aerial photographs and a combination of the straightest side and longest axis to determine the baseline for each field. Ten transects were established perpendicular to the baseline and equi-distant from the ends of the baseline and each other (Fig. 1). Subtransects were established between and perpendicular to the outermost transects and the field borders, creating a grid pattern that allowed for sampling of all areas of the field.

General observations and consultations with cooperating producers suggested that depredating birds concentrate their efforts within 60 m of the field borders. In order to determine the extent of this "edge effect", we established sample points at 15-m intervals for the first and last 60 m of each transect and at 60-m intervals for the middle section, creating 2 strata, the "edge" and "middle", respectively.

Transects were marked with 1.5-m tall PVC pipes topped with wire flags and plastic streamers to enhance visibility. Single, unprotected sample points were employed and marked with colored, numbered, wire flags to facilitate location during subsequent samplings. Flags were placed below the canopy to reduce the possiblity of attracting or repelling depredating birds. All fields but 1 were sampled twice between heading (when rice first becomes vulnerable) and harvest (approximately 30 days) to determine when ripening rice is most vulnerable. All fields received at least some damage control effort.

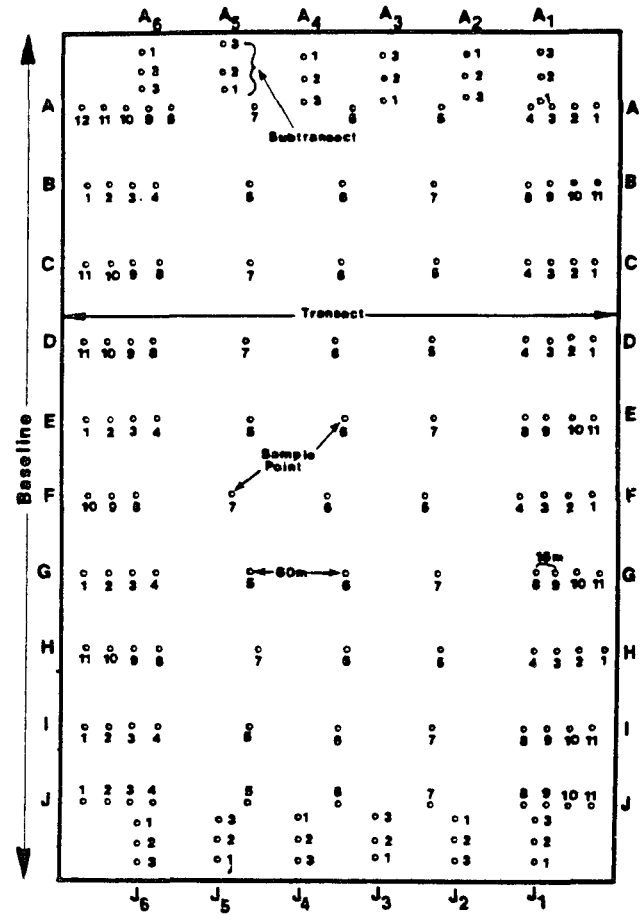

Fig. 1. Transect, subtransect, and sample point locations in a 38.8-ha ripening commercial rice field sampled for blackbird damage in Matagorda County, Texas, 1985.

Identifying Damage:

It is difficult to distinguish naturally blank grains from grains damaged by blackbirds during the milk stage because the birds pinch the grain to extract the milky white liquid, which results in intact, but empty, glumes (DeHaven et al. 1971, Meanly 1971). Lefebvre et al. (1983) and Manikowski (1985) found that grains pinched during the milk stage sometimes show white stains on the glumes. Therefore, only physically injured, missing, or empty, milk-stained grains were considered damaged by blackbirds in this study. We believe damage measurements

were conservative based on these criteria.

At each sample point we visually inspected the rice for blackbird damage, using feeding activity and empty hulls (since blackbirds will "de-hull" dough stage rice) on the ground as supporting evidence. If <3 damaged panicles were observed, damage was considered insignificant and recorded as 0%. If >2 damaged panicles were observed, we randomly collected 25 and 10 panicles in 1985 and 1986, respectively, within an approximately 2 m^2 circle. The stage of maturity was recorded as milk, dough (hard), or milk/dough. Samples were placed in small, labeled paper bags and handled carefully to reduce shattering. On 3 sampling dates the percent damage was visually estimated at each sample point for later comparison with the measured percent damage.

Data Analysis:

Samples were oven or air-dried to a constant moisture content (approximately 12%), weighed, and the number of damaged, missing, and present grains counted and recorded. Percent damage was calculated for individual panicles, sample points, strata, and fields using the formulas:

$$TGR = PGR + DGR + MGR$$

and

$$\text{Percent damage} = (DGR + MGR)/TGR \times 100$$

where

TGR = total grains before damage,
PGR = present grains,
DGR = damaged grains, and
MGR = missing grains.

No attempt was made to measure losses in rice quality.

In 1985 we collected 25 panicles at each sample point where damage was observed. However, sample analysis time (approximately 1.2 hours/sample) was impractical. To determine a subsample size that afforded a practical analysis time and sacrificed the least precision we selected 10 samples from each of 3 samplings for a 38.8-ha ratoon (second) crop field. For each of these samples, subsamples of 5, 10, 15, and 20 panicles were randomly generated and the means calculated for percent damage. These means were then compared with the means calculated for the entire sample (N = 25 panicles) by date (N = 10 samples).

Although damage tends to be higher along the edges than in the middle, there is no evidence that damage is predictable within these edge or middle areas of the field (Meanly 1971, Lefebvre et al. 1983, Manikowski 1985). Therefore, sample points within each stratum were pooled and statistical tests performed between strata.

To test the validity of assessing damage to individual panicles a 1-way analysis of variance (ANOVA) was employed to compare panicle size before damage (TGR) of damaged and undamaged panicles (since TGR was known to be correct for undamaged panicles). Statistical tests were performed on the overall percent damage for individual fields using weighted means and variances (Cochran 1977:91-96), since the edge and middle strata were sampled at different intensities.

Statistical analyses were not performed between sample point means due to the high within-field variability of damage. Sample point means were used to map damage distribution within the field and to compare visual estimates to measured damage. The Statistical Analysis System (SAS Inst. Inc. 1985) was used for all data analyses except tests performed on the overall percent damage.

RESULTS AND DISCUSSION

Transect Method Evaluation:

The time required to prepare a field for sampling (determining and measuring the baseline and setting out transect markers) ranged from 4 hours for small, symmetrical fields with easy access, to 8 hours for large, irregularly-shaped fields with limited access. Field sampling time depended on the amount of damage (since samples were not col-

lected at undamaged sample points) and the size of the field, and ranged from 4 to 20 hours.

The number of sample points established was determined by field size, since all areas of the field were sampled in order to map damage distribution. Smaller fields were sampled more intensively because the inter-transect distance was shorter and the area within 60 m of the field borders was proportionally greater.

Marking transects and sample points insured accurate location of both during subsequent samplings. It also saved approximately 6 hours of mapping sample points, because mapping was necessary only once for each field, instead of once for each sampling.

Subsampling 1985 Data:

Comparing sample means using the standard t-test is invalid when the sampled populations are not independent (Ott 1984:142). A comparison of the standard errors of the sample and subsample means for percent damage showed that subsample means were all within 1 SE of the sample mean except for the first sampling where N = 5 (Table 1). Thus, a subsample of 10 panicles appeared to afford the most practical analysis time with the least loss in precision, although the probabilities of Type I (rejecting a true null hypothesis) and Type II (accepting a false null hypothesis) errors using this approach are unknown.

Testing Accuracy of Damage Assessment:

Testing damaged and undamaged panicles for differences in size (TGR) between strata (edge and middle) showed no significant differences ($P > 0.05$) for any samplings (Table 2). Panicles pooled between strata by condition showed highly significant differences ($P < 0.001$) between damaged and undamaged panicles for several samplings (Table 2). However, for all these samplings TGR was higher for damaged, rather than undamaged panicles.

It is possible to underestimate, but not overestimate, TGR on damaged panicles because milk-stage damage is difficult to detect and missing grains cannot be mistaken for undamaged grains. All but 1 of these samplings were in ratoon crop rice, which ripens unevenly due to first crop harvesting equipment tracks and thinner plant stands. The birds may have been selecting for the ripest panicles, which are usually the largest. Thus, assessing blackbird damage to individual panicles appears to be valid, although damage may be underestimated.

Comparing Measured Damage to Visual Estimates:

To assess the reliability of visual estimates of percent damage, the measured percent damage was plotted against the difference of the measured percent damage and the estimated percent damage for each sample point, with similar results for all 3 samplings (Fig. 2). Visual estimates were too high at low (<5%) damage levels and too low at higher (>5%) levels, becoming increasingly so as the amount of damage increased. Lefebvre et al. (1983) compared the visual estimates of 3 investigators with actual damage for each of 3 60- x 60-cm plots suffering heavy damage. Individual estimates ranged from 0.56 to 1.35 times the actual damage, but the percent relative bias (mean of estimates/actual) varied only from -8 to 18%, suggesting that visual estimates by trained observers may be useful for large-scale surveys (i.e., over counties or regions). Our data suggest that observers may need experience estimating low as well as high damage.

CONCLUSIONS AND RECOMMENDATIONS

Assessing blackbird damage to individual panicles appears to be valid, although damage may be underestimated. This eliminates the need for labor-intensive paired protected and unprotected plots. However, individual panicle assessment is impractical for producers, as well as for investigators conducting regional surveys. The method could be employed in the evaluation and development of current and new control techniques. Monetary losses could be determined by applying percent damage figures to actual yields, and mapping

Table 1. Comparison of subsample and sample means for percent damage for panicles collected in a 38.8-ha ripening commercial rice field surveyed over time for blackbird depredation in Matagorda County, Texas, October 1985. Means were calculated using 10 samples from each sampling.

	No. Panicles Analyzed/Sample									
	5		10		15		20		25[a]	
Sampling	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
First	3.4*	0.59	5.5	0.92	4.9	0.63	4.4	0.45	4.6	0.45
Second	4.6	0.97	5.9	0.93	5.3	0.64	5.6	0.56	5.5	0.53
Last[b]	10.9	2.56	10.2	1.72	9.1	1.22	9.5	1.10	9.9	0.99

[a]Entire sample.
[b]Immediately prior to harvest.
*> 1 SE from the entire sample mean.

Table 2. F-values of nested analyses of variance of panicle size (total grains) for 7 ripening commercial rice fields sampled over time for blackbird damage in Matagorda County, Texas, 1985-86.

		Source of variation		
Field	Sampling	Stratum[a]	Panicle Condition[b]	Stratum x condition
B[c]-85[d]-R[e]	First	0.01	1.23	2.41
	Last	0.31	19.58***	0.59
B-86-F	First	0.34	0.19	0.35
	Last	0.04	0.05	0.18
C-85-R	First	0.02	14.48***	0.80
	Second	0.09	94.96***	2.94
	Last	0.31	32.89***	0.01
C-86-F	Last	0.30	1.07	0.02
C-86-R	Only	0.16	43.13***	0.48
M-85-F	First	0.00	0.00	0.01
	Last	1.05	14.26***	0.40
M-86-R	First	2.11	2.38	0.00
	Last	0.06	1.16	1.04

[a]<= and > 60 m from field border = edge and middle, respectively.
[b]Damaged or undamaged.
[c]Producer.
[d]Year.
[e]F and R = first and ratoon crop rice, respectively.
***P < 0.001.

damage could determine the effective range of various damage control techniques. Visual estimates may prove useful for regional damage assessment, but we believe observers should be experienced at estimating low as well

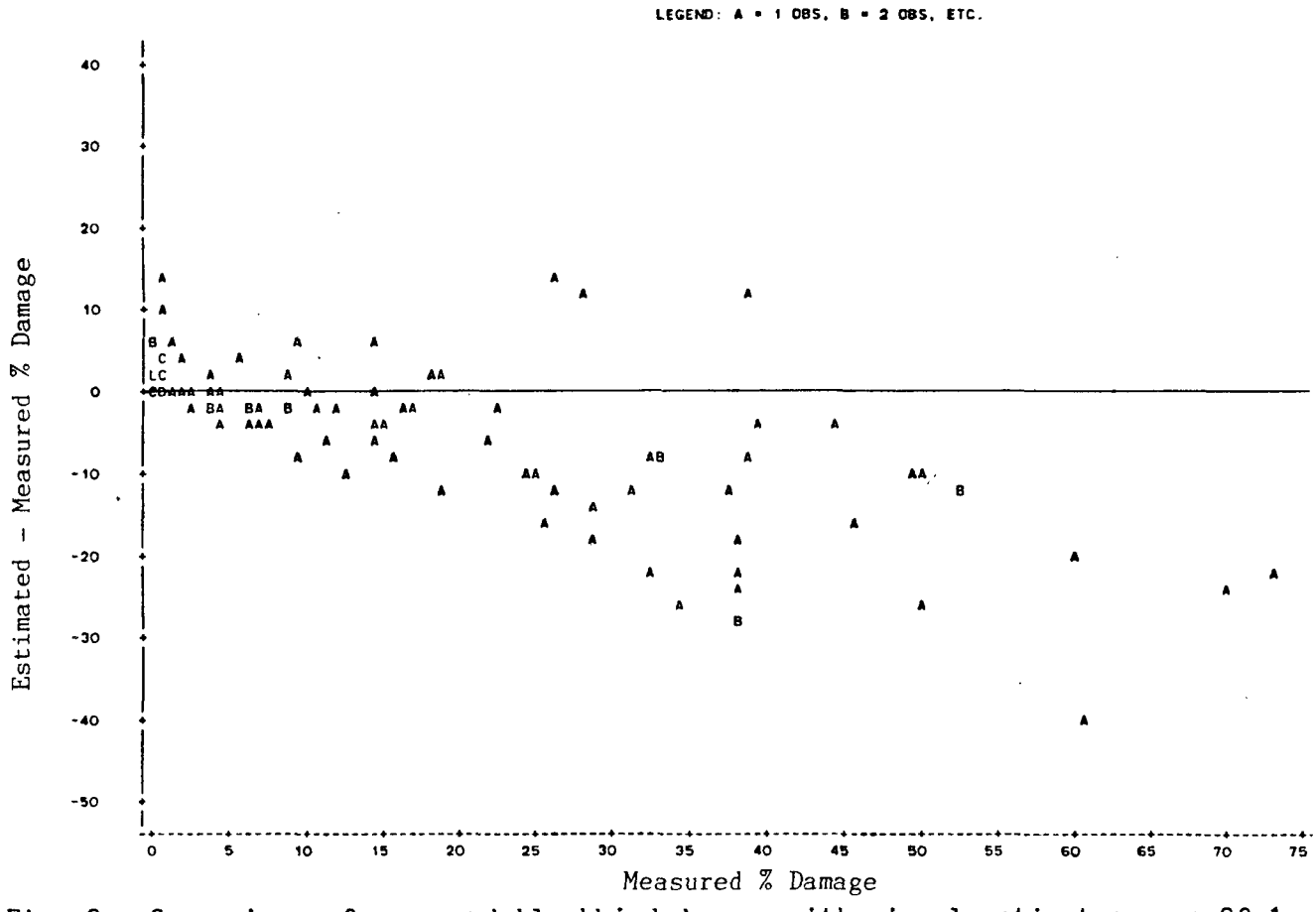

Fig. 2. Comparison of measured blackbird damage with visual estimates on a 20.1-ha ripening commercial rice field sampled 15-16 October in Matagorda County, Texas, 1986.

as high damage.

LITERATURE CITED

AVERY, M. L., and R. DeHAVEN. 1982. Bird damage to sunflowers in the Sacramento Valley, California. Proc. Vert. Pest Conf. 10:197-200.

BRUGGERS, R., and P. RUELLE. 1981. Economic impact of pest birds on ripening cereals in Senegal. Prot. Ecol. 3:7-16.

COCHRAN, W. G. 1977. Sampling techniques. 3rd ed. Wiley and Sons, New York, N. Y. 428pp.

CONOVER, M. R. 1984. Comparative effectiveness of Avitrol, exploders, and hawk kites in reducing blackbird damage to corn. J. Wildl. Manage. 48:109-116.

DeGRAZIO, J. W., J. F. BESSER, J. L. GUARINO, C. M. LOVELESS, and J. L. OLDEMEYER. 1969. A method for appraising blackbird damage to corn. J. Wildl. Manage. 33:988-994.

DeHAVEN, R. W. 1971. Blackbirds and the California rice crop. Rice J. Sept. Pages 7-8, 11-12, 14.

———, J. L. GUARINO, F. T. CRASE, and E. W. SCHAFER, JR. 1971. Methiocarb for repelling blackbirds from ripening rice. Inter. Rice Comm. Newsl. 20(4):25-30.

ELLIOTT, C. C. H. 1979. The harvest method as a means of avoiding quelea damage to irrigated rice in Chad/Cameroun. J. Appl. Ecol. 16:23-35.

HOLLER, N. R., H. P. NAQUIN, P. W. LEFEBVRE, D. L. OTIS, and D. J. CUNNINGHAM. 1982. Mesurol for protecting sprouting rice from blackbird damage in Louisiana. Wildl. Soc. Bull. 10:165-170.

LEFEBVRE, P. W., D. L. OTIS, N. R. HOLLER, R. E. MATTESON, and C. D. HILLMAN. 1983. Assessment of bird damage in ripening rice. Denver Wildl. Res. Cent. Bird Damage Res. Rep. 281. 13pp.

MANIKOWSKI, S. 1985. Evaluation of bird damage to mature rice. FAO Plant Prot. Bull. 33(3):90-99.

MEANLY, B. 1971. Blackbirds and the southern rice crop. U. S. Fish Wildl. Serv. Resour. Publ. 100. 64pp.

OTT, L. 1984. An introduction to statistical methods and data analysis. 2nd ed. PWS Publ., Boston. 775pp.

SAS INSTITUTE, INC. 1985. SAS user's guide: statistics. 1985 ed. SAS Inst., Inc., Cary, N. C. 956pp.

STICKLEY, A. R., JR., D. L. OTIS, and D. T. PALMER. 1979. Evaluation and results of a survey of blackbird and mammal damage over a large (three-state) area. Pages 169-177 in J. R. Beck, ed. Vertebrate pest control and management materials. ASTM STP 680. Amer. Soc. Testing Materials, Philadelphia.