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EXPERIMENTAL USE OF AV-ALARM FOR REPELLING QUELEA FROM RICE IN SOMALIA

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The Av-Alarm is a device for producing loud intermittent sounds which are sometimes effective in repelling pest birds or mammals. (Av-Alarm is manufactured by Av-Alarm Corp, P.O. Box 2488, Santa Maria, California 93454.) The sound is intended to irritate or cause anxiety in animals, perhaps by interfering with normal sound communication sufficiently to repel them from the area. Boudreau(1972) and Stewart (1974) report factors relating to alarm stimuli in bird control. Stewart (1974), HcCracken (1972) and Palmer (1976) reported the use of Av-Alarm in repelling pests under several different situations. However, Jeffrey Jackson (pers. comm.) has reported the use of Av-Alarm in a Red-billed Dioch (*Qualea qaelea)* breeding colony with no apparent success in interfering with reproduction.

In Somalia there are several bird pest species that attack grain crops. The greatest pests to rice are Quelea and the Red Bishop *(Euplectes orix).* In experimenting with various methods of protecting rice in Somalia, I used one Av-Alarm unit to determine the effectiveness in repelling Quelea in the long rainy season of 1975 and repeated the experiment in 1976.

METHODS

Bird Numbers

An Av-Alarm model ST 3XL with three speakers was placed 5 meters into the middle of the end of a 300 m x 1242 m field (36 hectares) of rice on 16 September 1975. It was one of six similar fields located in an irrigation development scheme at Mordinle, approximately 35 kilometers southwest of Magadiscio near the Ueba Scebelli River. The Av-Alarm had the center speaker pointed straight down the middle of the field with the other two directed toward opposite sides of the field at approximately 50 degree angles away from the center speaker. Speakers were at 3 m above the ground.

The Av-Alarm system commenced operation on 16 September and terminated on 8 October. It was programmed to operate from dawn to dusk -- a photoperiod of 12 hours -- and had a mode cycle of 10 seconds “on” (4 bursts per second) followed by 60 seconds “off.” The sound level was at “full” volume. The source of power was a large 12-volt truck battery, which when fully charged lasted at least four days.

Counts of birds in the experimental rice field were made for two minutes, twiceweekly between 0615 and 0700 by three observers on each date beginning 20 September. The field was divided into plots (bands) 50 meters wide and 300 meters long (the width of the field) beginning at the site of the Av-Alarm. Bird counters stood on one side of the field on a raised irrigation canal bank and counted all birds within the plot during a two-minute period. Binoculars were used as an aid in estimating bird numbers and species. Counts were first made only at 0-50 meters, 50 to 100 meters, and 100-150 meters. On 27 September a fourth plot was added between 150-200 meters.

A repeat of the experiment was made on the same field planted to rice in 1976, beginning on 21 August and terminating at harvest on 14 September. The only differences in methods were: (1) only two of the three observers employed in 1975 were used to count birds, and (2) the loudspeakers were at 1.7 m rather than 3 m above the ground.

Damage Assessment

A damage assessment was done at the beginning and end of the experiment. Transect lines were run out at approximately 45, 67, 90, 112 and 135 degree angles from the horizontal with the Av-Alarm unit as the central point. Where these transect lines reached the 50, 100, 150, 200, and 250 meter points a sample of rice was assessed for damage. Another sample was taken 20 meters toward the Av-Alarm from the first sample on each of the transect lines. Thus samples were taken at 30, 50, 80, 100, 130, 150, 180, 200, 230, and 250 meters on each of the 5 transect lines.

In 1975 two observers examined 50 heads each at sample sites, estimating damage to the nearest 5 percent on each head. Thus, for each concentric half-circle radiating out from the Av-Alarm unit there were 10 samples of 50 heads of rice each. In 1976 only one of the previous observers was used to make damage assessments. Damage assessments also were made in the 1150-1200 meter region at the distant end of the rice field at set points, 5 at 1200 meters and 5 at 1180 meters.

An analysis of variance was used to determine differences between means and to determine if damage were distributed evenly throughout the concentric bands of rice. A regression analysis was used to analyze the bird count data to determine if there were a linear trend of increase in number with the increase in distance from the Av-Alarm.

RESULTS

Bird Counts

Results of the bird counts are shown in Table 1. These data are of value for showing several trends. At first appraisal, the Av-Alarm appears to have an effect on bird numbers, the numbers increasing at more distant interval bands. There were increasing numbers of birds (primarily Quelea) in the interval bands with passage of time in 1975. As I will show later, this was at least in part due to an increased number of birds in the area, although some habituation to the sound may have occurred. A regression analysis for linearity determined that there was not a linear increase in bird numbers with increase in distance from the Av-Alarm.

The 19th day count in 1975, showing large numbers of birds in the band nearest the Av-Alarm, is somewhat misleading. Rice was under harvest on this day and much had fallen on the ground. Birds were grouped together in large flocks, and at the time the count was being made the birds were feeding on the ground between 125 and 175 meters from the Av-Alarm.

For overall assessment of bird numbers, it is not evident that the Av-Alarm has a marked effect. However, the measurement of numbers alone does not mean that the birds present are all feeding on the rice. Birds may alight on the rice but may move before they have an opportunity to feed.

Bulldup of Quelea Numbers in Surrounding Region

1975. By early September, 1975 there were several million Quelea roosting within a 25 kilometer radius of the rice scheme in Mordinle. On 6 September, a small roost of perhaps 100,000 Quelea was located in a maize field adjacent to the field in which the Av-Alarm was placed on 16 September. On 13 September two small flocks of Quelea were observed feeding on rice, and greater numbers were observed 14 September, whereas the birds roosting in the maize had departed. On 16 September there were few birds; by 23 September there were many more small flocks with further increases by the 27th. On 28 September there were 5,000-10,000 Quelea observed in the 36-hectare experimental field. By 4 October, I estimated 500,000 Quelea feeding in harvested and unharvested portions of the total of 216 hectares of rice. From 4-17 October, numbers of Quelea continued to increase.

1976. In 1976 the Quelea population within a feeding radius of 25 km was estimated at between 1 and 2 million birds. When the experiment began on 21 August there was a roost of Quelea 6 kilometers from the 400-hectare rice scheme. All of these Quelea (between 250,000 and 500,000 birds) were flying directly to the rice each morning and returning each evening with nearly 100 percent rice in their crop sacs and stomachs. The population of Quelea attacking rice remained stable throughout the duration of the experiment.

Progressive Change In Feeding Habits

In 1975 extensive observations were made on behavior and crop and stomach contents of Quelea near the rice and at roost sites in the surrounding region. Through 8 September, very few Quelea were feeding on rice; the majority were eating small grass seeds produced as a result of unusually great rainfall throughout July and August. By 13 September, 20% of birds collected 600 meters from the rice had been eating rice, whereas at a roost less than 15 kilometers distance collected birds were eating only small grass seeds. By 28 September 50% of Quelea collected at 600 meters from rice had eaten nearly 100% rice. By 4 October, of Quelea collected at the same site, 80% had eaten rice only.

Behavior of Other Ploceids

Red Bishops and Fire-fronted Bishops (*Euplectes diadematus)* nested near the rice fields (Holcomb, 1977), and the Red Bishops began to feed in the rice. On 20 September 1975, 5 females and one male Red Bishop were feeding on rice within 10 meters of the Av-Alarm speakers. When bursts of sound occurred, they did not stop feeding. The behavior of these Red Bishops is similar to that reported to me by Jeffrey Jackson and Lee Martin in tests performed near Khartoum, Sudan.

Damage to Rice and Effectiveness of the Av-Alarm

There was not even distribution of bird damage within the 50 meter band intervals in 1975 or 1976 ($p < 0.01$). It was quite common to find that in samples from 10 sites of 50 heads each, perhaps only one or two sites would have several heads of rice damaged.

In 1975 there were two observers estimating damage to rice heads. An analysis of vari-

ance was used to discover if there were differences between the mean values determined by the two observers and if there were a difference in mean damage between five interval bands ranging from 0-250 meters from the Av-Alarm. The analysis revealed that there was no difference between the observers ($p>0.05$), but that there was a difference in damage in the different bands ($p<0.005$). The data were then partitioned to determine whether or not there was a linear increase in damage from 0-250 meters. The rate of increase in damage was linear from 0-250 meters, as evidenced by a highly significant linear term ($p<0.005$) and a small and insignificant quadratic term.

For 1975 data, a one-way analysis of variance was used to test for differences in the mean damage between various interval bands of interest in the rice field. Table 2 summarizes the results of these paired tests.

For the 1976 data, an analysis of variance was run for the five different interval bands between 0 and 250 meters. There was clear evidence of a difference in damage in the different bands ($p<0.005$). The data were then partitioned (as for the 1975 data) to determine linearity. The rate of increase in damage was constant from one site to another, proceeding from 0-250 meters from the Av-Alarm, as evidenced by a highly signficant ($p<0.005$) linear term and a small and non-significant quadratic term.

Further analysis of variance tests were run on the 1976 data to determine if there were differences in mean percent damage between paired interval bands in the rice field. The data from both 1975 and 1976 show very clearly that Av-Alarm does have an effect in repelling Quelea from rice and significantly reduces damage at least up to 150 meters (Table 2). As there is clear evidence of a repelling effect by Av-ATarm, using the regimen described here, it would be appropriate and of value to experiment using various combinations of altered settings to produce different sounds and timing of sounds with Av-Alarm and other acoustical devices for crop protection.

CONCLUSIONS

The Av-Alarm does have an effect in repelling Quelea from rice. Counts of birds were highly variable, and as a result no repelling action could be attributed to the Av-Alarm using these criteria. However, bird damage assessments on rice proceeding in 50 meter intervals from 0-250 meters showed a linear increase in damage. There is clear evidence that Av-Alarm has a repelling action on Quelea up to 150 meters.

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TABLE 1. Counts of grain-eating birds in the rice field at different intervals[1] from Av-Alarm unit.[2]

Day of Experiment	0-50 m band		50-100 m band		100-150 m band		150-200 m band		200-250 m
	1975	1976	1975	1976	1975	1976	1975	1976	1976
1	3.0	1.0	6.3	0.0	9.0	275.0		27.6	2.5
4	6.7	0.0	9.0	0.0	15.7	110.0		28.5	290.0
8	32.0	82.5	32.0	41.0	66.3	33.0	173.3	22.5	13.5
11	43.7	22.0	47.3	31.0	26.7	107.5	196.7	82.0	185.5
15	11.3	0.0	5.0	12.5	63.3	250.0	112.7	1.5	0.0
19	765.0	25.0	36.7	0.0	4.7	1.0	3.7	0.0	0.0
22		0.0		425.0		325.0		0.5	1.0
25		0.0		225.0		0.0		0.0	0.0
Mean for each year	43.6	16.3	26.4	91.6	34.3	137.7	121.6	20.3	61.6
Mean for two years	30.0		58.6		86.0		71.0		

[1]Because of the rectangular plots, beginning with the 0-50 meter band, birds at the the most distant corner would be counted up to 158 meters, 180 meters, 212 meters, 250 meters, and 292 meters, respectively.

[2]Two-minute counts of all birds in an area 50 x 300 m by three observers between 0615 and 0700 in 1975 and by two of the same observers between 0745 and 0810 in 1976.

TABLE 2. Estimated percent Quelea damage (Mean±S.D.) to rice at different intervals from the Av-Alarm using 500 head samples at each interval band in 1975 and 1976.

Year	0-50 m band	50-100 m band	100-150 m band	150-200 m band	200-250 m band	1150-1200 m band
1975	A 0.2±1.3	A 1.2±5.2	B 1.1±5.7	C 10.6±22.6	B 5.2±15.3	C 37.6±42.3
1976	B,I 0.7±3.6	F,G 1.8±7.1	D,E 3.5±5.1	J,K 4.3±14.5	D,F,H,J,L 5.5±14.0	E,G,I,K,L 4.6±13.0

A,B,C - Differences between these pairs of means; p<0.005

D,E,F,G,H,I - Differences between these pairs of means; p<0.01

J, K, L - No differences between these pairs of means; p>0.05