Evaluation of Certain Chemicals as Bird Repellents,[1]

A Preliminary Report

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This preliminary report is the result of experimental work with chemicals as possible bird repellents. This work was done at Oklahoma State University during the summer and fall of 1958, with screened candidate chemicals furnished by Dr. L. D. Goodhue, of Phillips Petroleum Co.[2], and Dr. R. R. Blumenthal, of S. B. Penick and Co., both of whom offered valuable assistance and suggestions. Other companies furnishing chemicals reported on in this paper are E. I. DuPont De Nemours and Co., and Niagara Chemical Co.

Throughout historical times, certain species of birds have been known to destroy crops. For example, it has been reported that from 2,000,000 to 20,000,000 blackbirds in individual roosts have been located in the rice fields of Arkansas. Annual loss of rice in that area has been estimated from 230,000 to 570,000 bushels with a cash value of $460,000 to $1,400,000 (Neff and Meanley, 1957). Professor Frank Davies, Oklahoma State University agronomist, has stated that there is a 100 percent yearly loss to birds of unprotected grain sorghum plots at the University Farm and a 0-50 percent yearly loss at the Perkins Farm. During this study, flocks of up to 4,000 brown-headed cowbirds *(Molothrus ater)*, several hundred starlings *(Sturnus vulgaris)* and house sparrows *(Passer domesticus)* have been observed and photographed by the authors feeding in grain sorghum study plots and feed lots.

METHODS OF PROCEDURE:

To facilitate a speed-up in testing chemicals, field tests were used rather than protected laboratory tests which fail to show the effects of weather.

Testing plots were selected for convenience, accessibility, ease in observing, and nearness to a large bird population. Mr. Albert Rutledge, Animal Husbandry herdsman for the University, and Professor Frank Davies, Agronomy Department, offered suitable areas for location of the test plots. These areas were prebaited with untreated sorghum grain until the birds were consuming in one day's time all the grain placed in the pans.

For the preliminary tests, varying concentrations of the candidate

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chemical repellents (0.25-1.0% of weight of grain) dissolved in a suitable solvent were added to kaffir grain. To assure coverage, the mixture was thoroughly tumbled in a quart jar.

One hundred fifty grams of the treated grain were placed in each pan or sink strainer, a different chemical in each pan. Plastic sink strainers were found to be more acceptable as receptacles than pans. The strainers did not rust, permitted rain to drain from grain, and were easy to handle and wash. Controls of untreated grain were interspersed with the treated grain or used as "floaters" around the borders of the plot (Table I). Observations of bird activity were made during tests and the grain remaining in the pans was weighed at the end of the test period. These two criteria were used to rate the effectiveness of the chemicals as repellents (Table II).

The large-plot pan-tests (Table III) were prepared in the same manner as those of the preliminary tests except that all pans were filled with grain treated with the same chemical. No untreated grain was used as controls, but the amount of treated grain consumed during the test was compared to the amount of grain consumed during the prebaited period.

A different technique was employed for the spraying of grain sorghum heads on standing plants in the field. Two fields, each with 200 rows 150 feet long were designated as test plots for the grain-head spraying (Table IV). The East Kaffir Field was divided into numerous small plots with interspersed controls. The West Kaffir Field was divided into two large plots, the control being larger than the area treated with the four chemicals (Table IV). These fields were sprayed when in the milk-dough stage with varying concentrations (no recommended standards have been set) of the candidate repellent chemicals by use of a portable hand-pressure sprayer. The rate of application was 30 gal./acre, again no standards having been set. The rows of later-maturing grain (plots 3, 6, 9 and 13) were sprayed when they reached the milk-dough stage. Field observations of visible grain-head-damage and bird behavior along with the weights of harvested heads were used as criteria for checking the value of each candidate chemical in repelling birds.

DISCUSSION:

Many variables had to be considered when testing the treated seed under field or simulated field conditions. Some of these variables could not be controlled under field conditions; for example, rainfall, sunlight, movement of birds from one feeding area to another, migrating flocks stopping off to feed, or rodents feeding upon the grain in pans. Rainfall varied, as did sunlight, from one test to another. For no apparent reason, birds were seen to move from an untreated grain plot, to feed at a nearby source of food, and then return as unexpectedly. Migrating flocks would sometimes stop for one or two days, clean up a plot and move on, not giving us a chance to test a repellent on them. Cotton rats *(Sigmodon hispidus)* forced us to abandon one pan-test plot despite the fact that 400 rats were trapped from the plot during a three-months period.

The rating of chemicals as bird repellents (Table II) was derived by considering the amount of grain consumed as a percent of the amount placed in each pan. We used the following rating for the degrees of repellency: good - when 25 percent or less of the grain was consumed; fair - 26-35 percent; and poor - 36-100 percent consumed. Of forty chemicals tested, the number of tests run was sufficient to rate only twelve chemicals. Of these twelve, six were rated good, one fair and five poor. There appears to be a fairly constant difference in degree of repellency between a 1.0 percent and 0.25 percent concentration of the same chemical. This suggests that a higher concentration of some chemicals might give complete protection. Anthraquinone, considered a standard repellent, revealed no repellency in these tests. It is possible that old material used had lost its repellency.

Table III indicates the percent of treated grain consumed in five tests of 20 pans each. Thiram (Arasan 42-S), a DuPont product, repelled birds so well that they did not return for two weeks after the chemical had been replaced by untreated grain. This chemical also repelled rodents from the plot. No further tests were conducted because cotton rat concentrations were too heavy.

The spraying of grain heads on standing plants in the field presented many problems. Spraying should be done when the grain is in the milk-dough stage, because birds first attack the grain at this time. A portable hand-pressure sprayer was used. No standards have been set for concentrations of chemical nor gallons of spray per acre necessary to repel birds. Therefore, we used concentrations that had proved effective in pan tests and rates of application standard for insecticides. We were unsuccessful in obtaining complete coverage of the heads with spray. Another big problem confronting us was the size of plots and the location of controls (Table IV). In the East Kaffir Field small plots were interspersed with small controls. For approximately two weeks after treatment birds appearde to feed more heavily in the control strips than in the treated plots. After this time all plots were invaded and by the end of five weeks practically all of the grain in the entire field had been eaten.

In marked contrast the much larger treated area in the West Kaffir Field was not visited regularly by large numbers of birds despite the fact that the adjoining control attracted several thousand cowbirds at times and large numbers of house sparrows practically every day. The difference in the food consumption was measured by weighing 100 heads selected at random from each treated plot and a comparable sample from the control. As shown in Table V there was a very marked difference in the average weight of the samples of heads from the treated and untreated areas showing that the chemicals had given considerable protection. The degree of repellency tended to be greater in the plots extending away from the control until the end of the field was reached. This is in evidence (Table V) in that the plot adjoining the control had only 45 percent more grain, the next two plots 106 and 119 percent more, whereas the end plot only 76 percent more grain. Feeding birds were observed to concentrate in the field borders. This habit may account for the heavy consumption of grain in Plot 1.

CONCLUSIONS:

A study of the value of certain chemicals in repelling cowbirds and house sparrows from grain indicates the following conclusions:

1. Plastic sink strainers as receptacles for grain in preliminary tests were found to be more satisfactory than pans.

2. Location of these sink strainers in open areas available to wild birds proved highly successful for preliminary testing of candidate repellents.

3. Consumption of treated grain as a percent of total grain placed in each pan was used as a measure of repellency.

4. To allow for erratic movements of birds and bird behavior pan tests should be carried on for at least seven days. Field tests on standing grain should cover a period of several weeks or more.

5. Certain chemicals used in pan tests gave almost complete protection and apparently discouraged birds from feeding in those plots for some time after treated grain was replaced by untreated grain.

6. Prebaiting was necessary to attract birds to an area. The amount of grain consumed during the prebaiting period was used as an index of consumption and also used as a control in some cases.

7. A large area made up entirely of treated plots was more effective in repelling birds than a comparable-sized area of small plots interspersed with controls.

8. Field observations of birds were necessary to evaluate the repellency of chemicals.

Literature Cited

Neff, Johnson A. and Brooke Meanley. 1957. Blackbirds and the Arkansas rice crop. Univ. of Arkansas Ag. Exp. Sta., Bull. 584, 80 pp.

Table I. Layout of preliminary test plot showing coded chemicals and control arrangement.*

1255				1274
	1267		1256	
		Control		Floating Control
	1265		1275	
1266				1273

*Modifications of this plot layout included three columns of 5-6 pans each with interspersed controls.

Table II. Rating of candidate chemical repellents based on amounts of grain consumed by birds.

		Number of tests		Avg. amt. of grain	Rating as repellents		
Code	%	Tests	Total pans	eaten by percent	Good	Fair	Poor
* 978	1.0	2	4	84			x
*1058	1.0	3	3	50			x
*1255	1.0	5	6	15	x		
*1255	0.25	4	4	23	x		
*1265	1.0	3	3	16	x		
*1266	1.0	3	3	11	x		
*1267	1.0	2	4	50			x
*1267	0.25	2	3	78			x
*1273	1.0	3	3	17	x		
*1273	0.25	3	3	26		x	
*1274	1.0	3	3	8	x		
*1274	0.25	3	3	16	x		
*1275	1.0	3	3	6	x		
*1275	0.25	3	3	4	x		
**Alvar		2	3	100			x
†Anthraquinone	1.0	2	3	100			x
Anthraquinone	0.5	3	5	100			x
††Kolo "500"		2	3	100			x

*Phillips Petroleum Co.

**Shawinigan Products Co.

†American Cyanamid Co.

††Niagara Chemical Co.

Table III. Chemically treated grain sorghum seed consumed by birds in large pan test plots.

Chemical	%	No. of pans	% eaten
*Phillips #978	1	20	100
Phillips #1255	1	20	33
**Niagara "Bitters"	5	20	40.9
†Thiram (42-S Arasan)	5	20	13.6
Thiram (42-S Arasan)	5	20	0.0

*Phillips Petroleum Co.

**Niagara Chemical Co.

†I. E. Du Pont DeNemours and Co.

Table IV. Diagram of field layout for spray test of grain sorghum heads.

West Kaffir Field

Plot No.	Number of Rows	
5.	125	Control
4.	15	1255 (2%)
3.	9	1255 (1%)
2.	15	1275 (1%)*
1.	35	B-5-2TV (6%)

← 150′ →

← 600′ →

East Kaffir Field

Plot No.	Number of Rows	
1.	14	1255 (1%)
2.	14	Control
3.	12	1255 (2%)*
4.	17	1275 (1%)
5.	17	Control
6.	8	1255 (2%)*
7.	13	B-5-2TV (6%)
8.	13	Control
9.	16	Thiram 42-S (5%)*
10.	11	978 (1%)
11.	23	Control
12.	16	B-27 (15%)
13.	20	Thiram 42-S (5%)*
14.	4	353 (1%)

← 150′ →

*These plots matured about 30 days after the grain was in the milkdough stage in the other plots. At the time these plots were sprayed heavy feeding was already in progress in the other plots.

Table V. Harvested grain from representative samples of West Kaffir Field

Plot	Wt. of 100 Heads in Gms.	% More Grain Than Control
1.	1932	76
2.	2298	119
3.	2130	106
4.	1590	45
5.	1097	—