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Richard A. Dolbeer
Patuxent Wildlife Research Center, Ohio Field Station

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U.S. Bureau of Sport Fisheries and Wildlife
Patuxent Wildlife Research Center, Ohio Field Station
Sandusky, Ohio 44870

Introduction

Over 20,000 acres of highbush (cultivated) blueberries are grown in the United States (Johnston *et al.* 1969). The major producing states are Michigan, New Jersey, North Carolina, Washington, Indiana, and Oregon. Bird damage to blueberries is widespread and sometimes severe (Vaile and Moore, 1968; Pearson, 1958; Hayne and Cardinell, 1949; and Schwartze and Alcorn, 1960). Unfortunately, accurate estimates of less from birds are lacking.

Non-lethal methods of controlling bird damage are essential since much of the damage is caused by popular song birds protected by Federal law. Scare devices, including exploders and electronic broadcast alarms, are often used with variable effectiveness. Netting provides the best protection, but the high cost (over $100/acre/year) prohibits its use except for small plantings.

The use of low- or nonresidue repellents is a promising approach for non-lethal control of bird damage to agricultural crops. One such chemical (methiocarb [3,5-methyl-4-(Methylthio) phenol methylcarbamate]) has been effective in repelling birds from sprouting corn and ripening sorghum, rice, cherries, and grapes (Guarino, 1972). Promising results have also been achieved in a field test of methiocarb on highbush blueberries in Michigan (Stone *et al.* 1972) in which a latex sticker was added to the spray solution to increase chemical retention on the fruit.

Chemargo Division of Baychem Corporation* is interested in registering methiocarb as an insecticide applied to blueberries without the addition of a sticker. It would be a boon to growers if methiocarb, applied to blueberries as an insecticide, would also significantly reduce bird damage. Thus, the primary objective of our test was to determine the efficacy of methiocarb as a bird repellent when applied under conditions required for its registration as an insecticide (i.e., *sans* sticker and at a rate of 1 lb. active ingredient per 25 gal. of spray at 50 gal./acre, with a 14-day delay between application and harvest). A secondary objective was to obtain information on the species of birds feeding on blueberries and their behavior.

Procedures

Study Area and Methods. The test was conducted August 3-17, 1973, in Ottawa County, Michigan, about 20 miles west of Grand Rapids. The test locality,

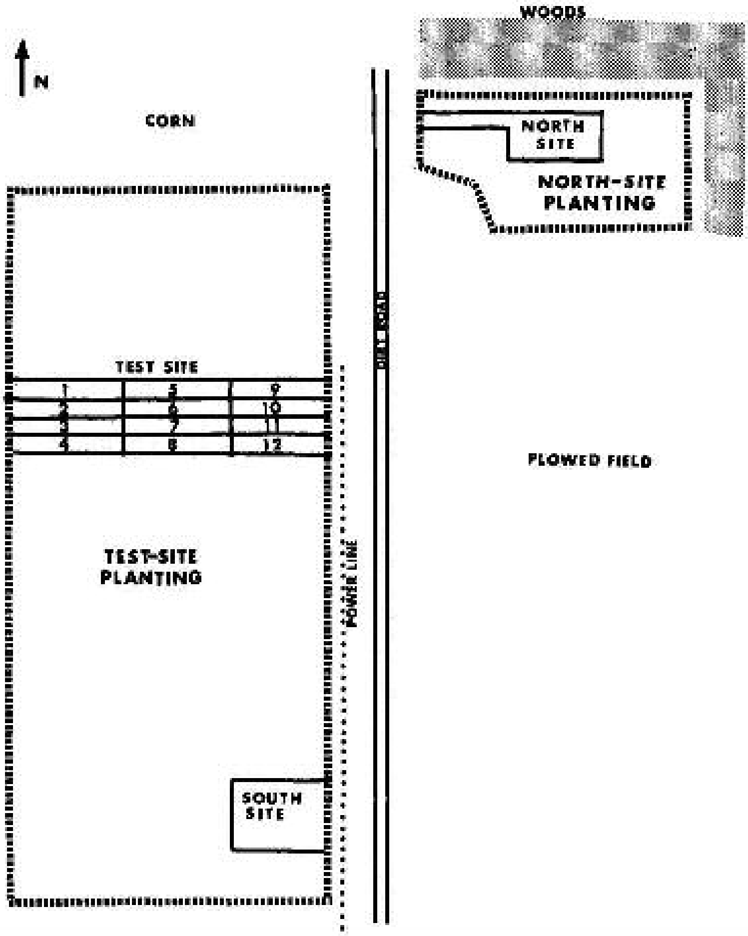

Figure 1. Map of Test Site, South Site and adjacent North Site.

hereafter referred to as the Test Site, was a 2.4-acre section of Colville blueberries located in the center of 30 acres of blueberries of other varieties. Test Sits produced a light crop in 1973 and was not harvested.

Chemical Test: Test Site, consisting of 16 rows containing 125 bushes each, was divided into twelve 30- by 200 ft. 3-row-wide plots, each about 0.2 acre in size and containing about 113 bushes (Fig. 1). North-south plot boundaries were separated by a 1-row buffer and east-west boundaries by a 2-bush buffer. Six plots were randomly selected for treatment, the other six served as controls.

On August 3, approximately 2 weeks before the main blueberry harvest would normally occur, treatment plots were sprayed with 1 lb. of active ingredient of methiocarb per 25 gal. of water at a rate of 50 gal. per acre (i.e., about 8 oz. per bush). The spray was applied with a Skibbe applicator, Model 50T 2NLPM, pulled by a Cub Cadet 122 tractor.

On August 2-3 before spraying, a 10 berry cluster was counted off and tagged at each cardinal point on each of 12 randomly-selected bushes per plot. Cheesecloth bags were placed over 12 randomly-located 10-berry samples in each of the four beffer rows. Damage assessment was made on August 17, 14 days after spray application. The remaining berries were counted on each marked cluster. The remaining berries were also counted on each bagged sample to estimate how much loss was from causes other than birds.

Damage assessment was also made in a planting (North Site) 200 yd. northeast of Test Site to estimate the level of damage to blueberries in an area not immediately associated with the treatment (Fig. 1). Four untreated plots of the same size and variety as in Test Site were marked on August 4 and assessed for damage on August 17 in the same manner as in Test Site. Sample allocation per plot was the same as in Test Site.

Precipitation at Test Site amounted to 0.34 inch August 3-16, all occurring on August 8. An additional 2.4 inches of rain occurred on the day of damage assessment, August 17, beginning when two-thirds of the bushes had been assessed.

Bird observations: Bird observations, conducted August 6-11 and 13-16, were divided into two parts:

1. Test Site observations -- One man observed Test Site 8 hours daily, alternating a schedule of 0600-1000 and 1400-18000 EDT on one day and 1000-1400 and 1700-1800 EDT on the next day. Test Site was divided into three 0.8-acre sections (plots 1-4, 5-8, 9-12) for observational units. Each 0.8-acre section was observed for 75 min. during each 4-hr. observation period. The order in which sections were observed was selected randomly for each 4-hour period.

   Observations were made from a portable blind mounted on top of a 6-ft. stepladder. The blind was placed in a direct line with the section of four plots to be observed during each 75-min. period. The number of birds for each species entering the 0.8-acre section was recorded along with relevant behavioral information.

   Two 0.8-acre plots (North and South Sites) located 200-300 yd. from Test Site (Fig. 1) were observed on 6 days between August 7-16.

North Site was located in a small (4-acre) planting separated from the Test Site planting by a dirt road. (Bird damage also was estimated in North Site.) South Site was located 200 yd. south of Test Site in the same planting. Generally, each of these plots was observed for two randomly selected 105-min. periods daily.

2. Off site-observations -- An 0.8-acre plot in each of four plantings (A, B, C, and D) located within a 10-mile radius of Test Site was observed daily for 105 min. The order of observations was randomly selected, and observations were made during the same time periods as in Test Site.

Results

Methiocarb Efficacy. Damage assessment revealed that 22.9 percent of the tagged berries were lost in untreated plots during August 3-17 compared with 20.6 percent in treated plots (Fig. 2). There was no significant difference ($P>0.10$) in loss rates between treated and untreated plots, and thus no significant protection was demonstrated (Table 1).

In bagged samples, 13.4 percent of the berries had dropped. Thus, estimated losses resulting from birds were about 7.2 and 9.5 percent in treated and untreated plots, respectively.

A 20-ft.-high powerline located on the east side of Test Site was used extensively for staging by birds and had some effect on the pattern of bird activity and damage. Bird activity decreased as distance from the powerline increased. Damage in untreated plots also diminished as distance from the powerline increased (Fig. 3). Damage in treated plots showed no consistent pattern. The center section of four plots (plots 5-8) showed the greatest difference between treated and untreated plots (12.0- versus 23.5 percent loss, respectively), which suggests protection (Fig. 3) at that locality. This damage pattern may indicate some variation in methiocarb efficacy with level of bird activity.

Depredating species. Robins, Starlings and Grackles (in that order) were the most common depredators observed. The relative abundance of these species varied somewhat from planting to planting (Fig. 4). Twelve other species were observed feeding in blueberries (Table 2); however, loss caused by these 12 species appeared minor compared with that of the three common species. It should be noted, however, that our observations only indicated number of birds entering plantings and not feeding rates.

General Bird Activity. A wide range of bird activity was recorded in the three test-site areas and four off-site plantings (Fig. 4). In off-site plantings A, B, and C, only 1-8 birds entered the 0.8-acre plots in 12-14 hrs. of observation per planting. Bird activity indices (birds entering plot per observation min.) were 0.001-0.010. Test Site and South Site, located 200 yd. apart in the same planting, had intermediate bird activity indices of 0.132 and 0.107, respectively. In off-site planting D, located 4 mi. from Test Site, and in North Site, bird activity was greatest with indices of 0.670 and 0.711, respectively.

Table 1. Analysis of variance of blueberry loss in Test Site, and mathematical model used in analysis of variance.

Analysis of Variance:

Source	df	Sums of squares	Mean square	F-ratio
Treatments	1	0.2006	0.2006	0.407†
Experimental error	10	4.9244	0.4924	
Sampling error	132	19.1824	0.1453	
Total	143	24.3075		

†Not significant (P>0.10), insufficient evidence to reject the hypothesis that treated and untreated means are equal.

Mathematical Model:

$$x_{ijk} = \mu + \tau_i + \varepsilon_{ij} + \delta_{ijk}$$

i = 1,….,2
j = 1,….,6
k = 1,….,144

where:

x_{ijk} is the square root of the number of blueberries present within the four (4) marked clusters on the kth subsampled bush within the jth replication of the ith treatment. The square root transformation approximates normality and homoscedasticity.

μ is the overall mean.

τ_i is the fixed effect of the ith treatment.

ε_{ij} is the experimental error; i.e., the effect associated with the jth replicate of the ith treatment, which is normally and independently distributed about a mean of zero (0) with a variance of σ^2_ε, NID (0, σ^2_ε).

δ_{ijk} is the sampling error; i.e., the random effect associated with the kth (sub)sample from within the jth replicate within treatment i, which is NID (0, σ^2_δ).

Table 2. Species observed feeding of blueberries, August 6-11 and 13-16,1973.

Species	Relative abundance in blueberry plantings
Robin	Very Common
Starling	" "
Grackle	" "
Blue Jay	Occasional
Cedar Waxwing	"
Common Crow	"
Brown Thrasher	"
Catbird	"
Orchard Oriole	"
Red-headed Woodpecker	"
Yellow-shafted Flicker	"
Rufous-sided Towhee	Rare (three observations)
Red-winged Blackbird (♀)	" (one observation)
Mourning Dove	" (one observation)

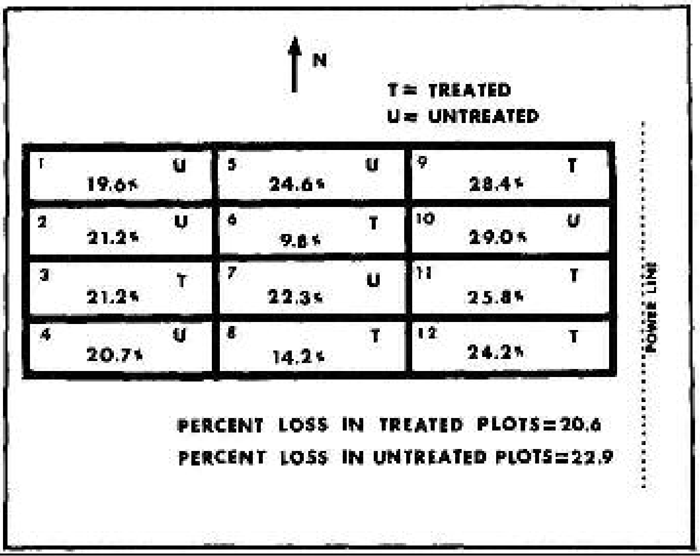

Figure 2. Percent loss of tagged berries, August 3-17, in treated and untreated plots at Test Site.

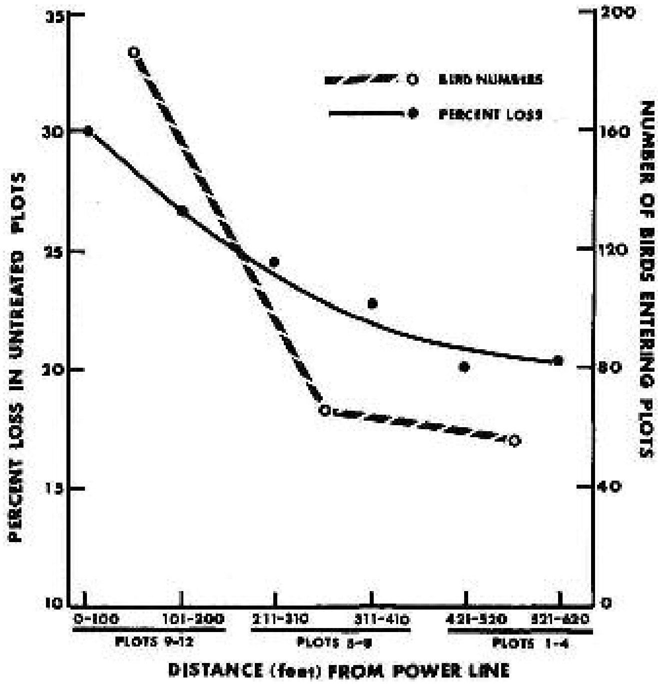

Figure 3. Percent loss of tagged berries in untreated plots in relation to distance from powerline, and number of birds entering plots in relation to distance from powerline.

The three plantings with least bird activity (A, B, C) were all similar in size (about 30-40 acres) and typical of plantings in Ottawa County, Michigan. All were located in areas where similar-sized plantings were prevalent. Woodlots were near these three plantings, but these woodlots were rarely used by birds as staging areas. Bird damage appeared minuscule in these plantings.

The two plantings with highest bird activity (D and North Site) were also the smallest plantings. Planting D (7 acres), which was isolated from other plantings, was the only planting within a 2-mi. radius and was located 100 yd. from a 1-acre grove of evergreens. The evergreens were used as a roosting and staging area by birds (mainly Robins and Starlings) feeding in the planting. Several powerlines crossed the planting and were also extensively used for staging. The North Site planting (4 acres) was not isolated but in close proximity to the Test Site planting and several other large plantings. However, the North Site planting was bordered on two sided by a woodlot of deciduous trees, 20-60 yd. away (Fig. 1). The woodlot was regularly used by birds as a staging ares.

The loss of berries in North Site August 4-17 was estimated to be 29.0 percent. If a similar loss by natural drop is assumed in North Site as was estimated in Test Site, loss to birds was an estimated 15.6 percent over the 13-day period or about double the loss in Test Site. Bird activity was an estimated 5.4 times greater in North Site than in Test Site (Fig. 4). However, the comparison between bird activity and blueberry loss is complicated somewhat since Starlings and Grackles constituted over 40 percent of birds entering North Site and less than 25 percent of birds entering Test Site (Fig. 4).

Test-site Bird Activity. We hypothesized that the combination of small plot size and indistinct boundaries between plots might prevent birds from adequately distinguishing treated from untreated plots. We felt that if the chemical was an effective repellent, this inability to distinguish might cause birds to avoid the entire 2.4-acre Test Site and feed alsewhere in the planting. However, the similar bird activity and species composition in Test Site and South Site (Fig. 4), plus subjective observations over the entire 30-acre planting, indicated that bird pressure was not any lower (and perhaps was even higher) in Test Site than elsewhere in the planting.

Daily fluctuations in bird numbers also gave no indication that birds were repelled from Test Site (Fig. 5). Robin numbers were highest August 8-9, 5-6 days after chemical application. Starling numbers were highest 3-4 and 12-13 days after application. These observations also indicated that day-to-day bird activity was highly variable with no consistent pattern. There were no obvious relationships between bird activity and weather conditions.

Daily Feeding Activity. Robins were most active in blueberry plantings early in the day (0615-1000), whereas Starlings were most active in the evening (1800-2100) (Fig. 6). Mid-afternoon (1400-1600) was the least-active period for both species. Too few data were collected on Grackles to accurately plot their daily feeding cycle.

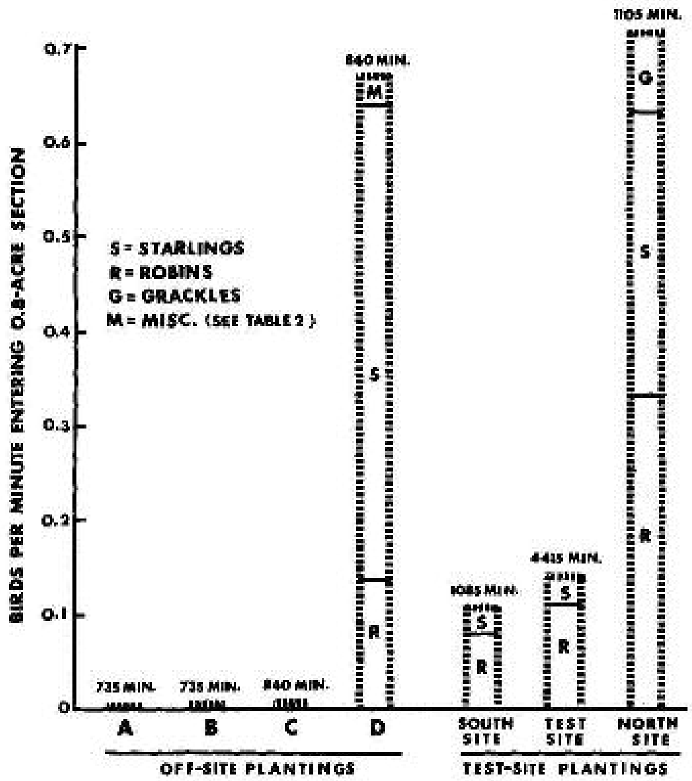

Figure 4. Bird activity indices for blueberry plantings observed August 6-16 in Ottawa County, Michigan. The number of minutes a section was observed is listed above the bar.

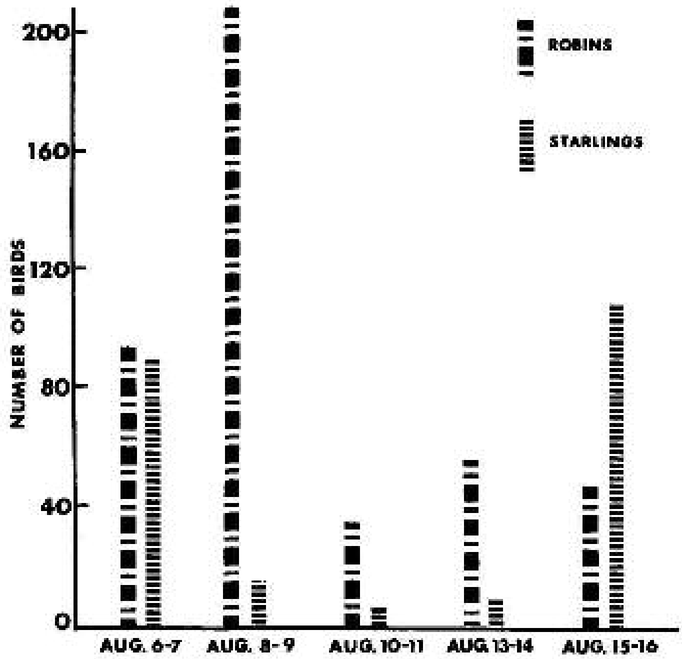

Figure 5. Number of Robins and Starlings observed entering Test Site for each 2-day period, August 6-11 and 13-16. The Test Site was observed for all daylight hours, 0615-2100 EDT over each 2-day period.

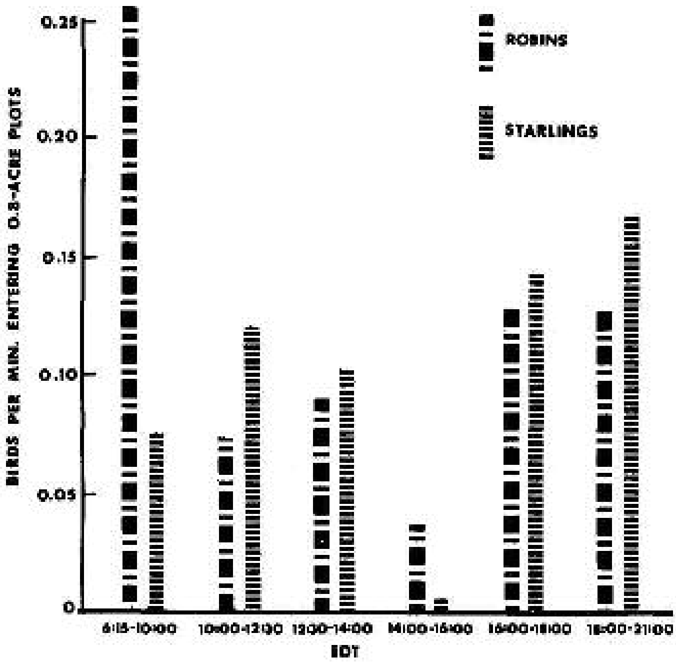

Figure 6. Daily activity patterns for Robins and Starlings in all observed blueberry plantings, August 6-16, 1973.

Discussion

Three possible explanations for the failure of methiocarb to reduce berry loss in the treated plots are discussed below.

First, methiocarb may be an ineffective bird repellent in blueberries, especially when used without a sticker solution. Since results of field tests using a methiocarb-sticker solution on cherries (Guarino *et al.,*1971) and blueberries (Stone *et al.,* 1973) have indicated reduced bird damage, the sticker may be an important factor. Further data are needed on retention rates of methiocarb on fruits when applied with and without a sticker.

Second, the efficacy of methiocarb may vary with the amount of bird activity. Considering the approximate 8-percent loss of berries to birds and the general level of bird activity in and around Test Site, there certainly appeared to be enough birds present to adequately test the chemical. Although methiocarb offered no significant overall protection, the pattern of damage in the center section of Test Site, where bird activity was moderate, did indicate substantial protection for that locality (Figs. 2 and 3). We have no explanation at present for the possible interaction between bird activity and methiocarb efficacy. Bird activity should be quantitatively measured and related to damage patterns when possible in future tests to gain further insight into this possible response.

Third, birds may have been unable to adequately distinguish treated from untreated areas because the plots were small and had indistinct boundaries. This design apparently did not cause birds to be repelled from the entire Test Site; however, it may have prevented birds from making a choice in a feeding site that they would have made if larger plots with more distinct boundaries had been used.

Griffin and Baumgartner (1959) and West, *et al.* (1969) concluded from field tests that designs with small, intermixed treated and untreated plots were not as suitable for testing repellents as designs where large plots were used and treatments distinctly separated. The lack of an experimental permit in 1973 prevented us from testing methiocarb more realistically over larger areas. Future field tests should be postponed until such a permit is obtained or a larger test site is available under other circumstances.

Bird observations in the various plantings did indicate that bird damage was more pronounced in small plantings than in large. Hayne and Cardinall (1949) made similar observations during the 1940's in Michigan. Their records showed that the total loss of berries in large and small plantings was often similar. However, since small plantings contained fewer bushes, the percentage loss was much greater than in large plantings. Protective netting may be an economical solution for small plantings with high losses to birds.

Our observations also indicated that staging sites (woodlots and powerlines) are often important contributors to higher bird damage. Whenever possible, powerlines strung across or near plantings should be buried or redirected away from the plantings. The removal of woodlots adjacent to plantings is not recommended. The increased yield of berries would rarely, if ever, adequately compensate for the loss of wildlife habitat, a potentially valuable source of lumber, and an esthetically pleasing woodland and environment.

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References Cited

Griffin, D.N., and F.M. Baumgartner. 1959. Evaluation of certain chemicals as bird repellents. Proc. Oklahoma Acad. Sci. 39:78-82.

Guarino, J.L. 1972. Methiocarb, a chemical repellent: A review of its effectiveness on crops. Proc. 5th Vertebr. Pest Control Conf.

Guarino, J.L., W.F. Shake, and E.W. Schafer, Jr. 1971. A concentration-effect study of the avian repellent methiocarb on ripening cherries in Michingan. Unpub. rep. Work Unit FD-102.2, No. 28. Denver Wildlife Research Center, lp.

Hayne, D.W., and H.A. Cardinall. 1949. Damage to blueberries by birds. Mich. Bull. 32(2):213-219.

Johnston, S., J. Moulton, and J. Hull, Jr. 1969. Essentials of blueberry culture. Mich. State Univ. Extension Bull. E-590, Farm Sci.Ser. 16pp.

Pearson, E.W. 1958. A study to find the cause and remedy for bird damage to cultivated blueberries in Massachusetts. M.S. Thesis. Univ. Mass., Amherst. 93pp.

Schwartze, CD., and G.D. Alcorn. 1960. House finches' feeding menaces cultivated blueberries. The Murrelet 41(1):8-9.

Stone, C.P., W.F. Shake, and D. Langowski. 1973. Reducing bird damage to highbush blueberries in Michigan with a carbarnate repellent. Unpubl. rep. Work Unit DF-102.3, No. 39, Denver Wildlife Research Center. llpp.

Vaile, J.E., and J.N. Moore. 1968. Bird damage to blueberries. Ark. Farm Res., Ark. Agric. Exp. Sta., Univ. Ark., Fayetteville. lp.

West, R.R., R.B. Brunton, and D.J. Cunningham. 1969. Repelling pheasants from sprouting corn with a carbamate insecticide. J. Wildl. Manage. 33(1):216-219.