

INNOVATIVE TECHNIQUES TO CONTROL BIRD DAMAGE AT FEEDLOTS

by

CHARLES D. LEE

B. S., Kansas State University, 1975

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

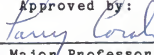
MASTER OF SCIENCE

Department of Animal Science and Industry

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LITERATURE REVIEW

Bird Damage at Feedlots

The Kansas feedlot industry is large, diverse and rapidly growing. Unfortunately feedlots having open bunks with continuously available feed also provides starlings (*Sturnus vulgaris*) and several species of blackbirds (*Icterinae*) with an abundance of winter food. In this environment they are considered serious economic pests (Besser et al. 1968, Feare 1975, 1978, 1981). Damage results from feed consumption, feed contamination, and the possible spread of disease (Twedt and Glahn 1982). During winter, after their natural food of soft fruit and insects are depleted, flocks of up to 500,000 birds concentrate at livestock operations and consume large quantities of feed (Fowler 1967). Studies show that a single starling could consume about 1 pound of pelleted feed per month directly from the feed bunk (Besser et al. 1968). Thus seasonal economic loss from starling damage can be a significant factor. The Kansas cattle feeding industry is losing \$2,400,000 annually due to birds (Lee 1987).

Attempts to assess feed loss due to birds have been limited. Besser et al. (1968) developed a formula that relied on number of birds present to calculate feed loss. Glahn and Otis (1982) cited several factors that make this

type of approach unreliable:

1) Direct measurement of the feed loss is impossible except in experimental situations.

2) Bird numbers are difficult to estimate and vary throughout the day.

3) Feed consumption depends on availability of other food sources and weather conditions.

4) Food habit stomach analysis leaves some question about the source of the food.

Glahn and Otis (1982) determined that assessing starling depredations at livestock feeding areas is feasible by using bird activity estimates. They developed a regression model to predict feed consumption by starlings based on the number of starlings visiting a feed source. This approach can account for the variability in bird depredations over time due to environmental factors.

Feed types must also be considered when evaluating feed loss due to birds. Crabb (1978) found starlings selected a higher percentage of high protein components from animal rations than what is present in the ration as fed. In other research, starlings selected the more expensive protein pellets than the crushed barley portion of the ration (Feare and Swannack 1978).

Another problem associated with starlings is the contamination of the feed, feed bunks, milling facilities and the cattle themselves. Deposits of starling feces on

animals and in buildings provide unpleasant working conditions for producers. Feedlot operators also report that starling feces on cattle feed renders it less palatable to cattle.

In a study conducted in Kentucky, Glahn and Stone (1984) allowed various levels of starling excrement to fall on feed for periods ranging from 30 to 56 days. No significant differences were observed in daily rate of gain or efficiency of feed conversion. Feed rejection did not appear to be a problem. These data suggests that neither cattle or pigs appear to be adversely effected by exposure to starling excreta in their feed. One group of calves grew faster than the control group. The explanation was that bird feces, rich in uric acid presented the calves with an added supply of nitrogen.

This is not unexpected since several studies have shown that poultry manure makes an acceptable foodstuff for cattle at low concentrations (Brugman et al. 1964, El-Sabban et al. 1970, Oltjen and Dinius 1976). These findings suggest that there is no economic justification for starling control at livestock feeding operations based solely on feed contamination.

Another potential problem with birds at feedlots is the potential for disease transmission. Many feedlot operators are concerned that birds are responsible for outbreaks and spread of disease (McCaffery, Barton Co. Land and Cattle,

pers. commun.). Starlings have been implicated in the spread of transmissible gastroenteritis (TGE) of pigs. Gough and Beyer (1980) determined that starlings can carry the TGE virus and that the virus can pass through the digestive tract of starlings and be infectious in the starlings feces. Starlings may eventually be implicated in the transmission of other animal diseases. Feedlot operators believe starlings are responsible for coccidiosis spp. outbreaks but there is no good current research to support this. This represents an area where future research needs to be directed so that the role of starlings in disease transmission can be assessed.

Not all feedlots have a problem with birds. Glahn and Otis (1986) reported on factors that influenced blackbird and starling damage at feedlots. They determined that damage is likely to occur when large livestock farms, expose a large amount of grain in close proximity to winter starling roosts during severe winter conditions. These conditions are satisfied in certain Kansas locations.

This thesis reports on a variety of innovative techniques that could be utilized to reduce damage due to birds.

Methods of Controlling Birds

Dimethyl Anthranilate Used as a Feed Additive

Traditional methods of control of problem birds at

feedlots are to kill, trap, or frighten away the birds involved. Field studies involving the use of toxicants have been conducted at a number of cattle feedlots (Besser et al. 1967, Decino et al. 1966, Marsh and Brock 1964, Glahn 1981). Research on the use of sonic devices were reported by Zajanc and Sprock (1965). Traps have been utilized to reduce bird numbers at California feedlots (Johnson et al. 1964).

The greatest limitation of these techniques is they fail to create an environment that is less optimal for the birds (Twedt and Glahn 1982). Birds can rapidly reinfest an area when these techniques are terminated. Researchers have generally relied on a single approach to control birds. Palmer (1976) reported on the integrated systems approach to controlling birds at feedlots. This approach involves the interaction of human attitude, cultural control practices and the proper application of bird damage control techniques. Reportedly, when the current control techniques are integrated they function much more effectively.

Twedt and Glahn (1982) listed livestock feeding management practices that could be used to reduce feed loss to birds. They reported the best means of reducing losses was to physically separate the feed from the birds. Feeding livestock in bird proofed buildings has reduced feed loss by starlings and also improved animal performance (Feare and Swannack 1978). Feeding cattle only at night when the birds are not present has significantly reduced weight gain in

cattle (Crabb 1978).

Twedt and Glahn (1982) suggested using a form of feed that could not be physiologically utilized by birds. Wornick (1969) reported losses to birds can be minimized when feeding liquid supplements. Glahn and Otis (1982) found starlings consumed 3/16 in diameter pig pellets eight times faster than granular hog meal. Starlings appear to have a preference for certain feed forms and sizes. By limiting this preferred feed form bird depredation can be minimized.

Another suggestion by Twedt and Glahn (1982) was to use feeds that are unpalatable to birds. Birds have a sense of taste (Kare and Mason 1986). Tastants do exist that are unpalatable to birds but readily accepted by mammals (Mason et al. 1983). One such product is dimethyl anthranilate (DMA), a non toxic food flavoring approved for human consumption but offensive to birds.

Mason et al. (1983) reported that DMA could significantly reduce the consumption of Purina Flight Bird Conditioner feed by birds in a laboratory situation in both 1 and 2 choice tests when birds were deprived and satiated. DMA was utilized at levels from 0.0% - 1.6%. Mason et al. (1983) suggested that DMA may be useful in some feedlot situations. They listed four advantages to the product.

- 1) The compound would result in a less optimal food source.
- 2) Starlings do not become accustomed to the taste of the

compound.

- 3) Efficacy could be improved by applying DMA directly to the feed rather than a bait source.
- 4) DMA is relatively inexpensive.

Other research with DMA has supported these findings. Rogers (1978) suggested efficacy of control compounds depended upon type of material to be protected. Preferred foods may be harder to protect and the availability of alternative foods may influence DMA results.

DMA may be most effective with omnivorous birds such as starlings that use both taste and vision for food selection (Reidinger and Mason 1983). Current research to investigate the physiochemical basis of this DMA repellency is in progress (Mason pers. commun.).

DMA is no longer relatively inexpensive. DMA appears to be a concentration dependent chemical (Mason et al. 1985). Increases in the price of DMA from \$2.00/lb. to \$11.00/lb. has prevented the use of DMA by feedlots at levels previously reported to repel birds.

Low level concentrations (0.06%) have been tested because that is a level considered to be currently economically feasible (Williams, Ralston Purina, pers. commun.). Researchers are currently evaluating low level concentrations of DMA and other cost effective methods of utilizing the product (Glahn pers. comm.).

Control of Starlings Using Electricity

There are a number of control methods being researched to control starlings. Starlings have a habit of landing on electric wires (Feare 1984). This behavioral trait offers possibilities for controlling birds by mass electrocution. This idea received wide spread support from feedlot operators and has several advantages.

- 1) Toxicants and their inherent environment hazards could be avoided.

- 2) Visual inspection of the line could prevent non-target species kills.

- 3) Producers could see immediate results to their control efforts.

Poultry processing plants involve electrically stunning birds and then severing neck blood vessels. An objective in stunning poultry is to maximize blood removal from the carcass. Kuenzel and Ingling (1977) tested A.C. and D.C. circuits of different voltages to maximize blood removal. They determined that A.C. current above 130 V lead to heart stoppage or cardiac fibrillation. No D.C. current range tested (50-140 volts) caused heart stoppage.

Experiments were carried out in 1962-1963 to determine the most effective electrical path through the bird (Jacob and Zajanc 1964). The researchers determined that the birds showed considerable variation in response. The most

sensitive pathway was foot-to-mouth. When surfaces were dry, voltages below 5 to 8 kv, D.C. or A.C. produced negligible response in the birds. Jacob and Zajanc (1964) concluded to effectively stun or kill birds voltages from 8 kv - 14kv were required. Voltages over 14kv developed "hissing noises" and birds refused to alight. Although birds that did land were stunned and fell immediately without emitting a distress call.

The Use of Hawks in Bird Control

Falconry is a medieval sport that has some modern day applications for bird control. Most pest birds are prey of larger birds. Trained raptors have been used as a means of bird scaring. Researchers have reported on the use of falcons to clear birds from airports since 1947 in Britain (Blokpoel 1976, Heighway 1969). Blokpoel (1976) indicated that properly trained birds of prey used daily in good weather and during daylight conditions could reduce pest birds at airfields. Keeping the birds was time consuming and costly. Proper training and skilled personnel were necessary to ensure success. He points out several falcons are needed to insure that a raptor is always ready to fly.

With these restrictions in mind it is not surprising that trained raptors have not been used in commercial agricultural situations (Inglis, 1979). A research trial reported in the literature compares the influence of human

and goshawk (Accipiter gentilis) activity on wood pigeons (Columba palumbus) at brassica feeding sites (Kenward 1978). He found that the pigeons resettled immediately on the same feeding site after 23% of the goshawk attacks. The shorter the time the pigeons spent feeding in the area the sooner they returned to the area after an interruption. Goshawks were not able to repel pigeons from their feeding sites for long periods even when the attacks were successful and repeated.

Kenward reports the goshawk had not been a widespread British breeding species for the last 200 years. The absence of significant goshawk predation may have lead to a reduction in the pigeon's response to the predator.

In order to avoid some of the problems with using trained raptors, radio-controlled model aircraft shaped like hawks has been tried on airfields and cropfields (Blokpoel 1976, Ward 1974). Some bird species could be flushed and driven off by the model aircraft but others did not appear to be bothered. Birds quickly returned to the crop fields when the model planes landed. Skilled operators continuously on call are required. It is not certain if a realistic hawk shape is necessary since Garrity and Pearce (1973) reported success in flushing robins (Turdus migratorius) from blueberry fields using an unmodified model aircraft.

Observations have been reported of other species of

raptors killing individuals and dispersing flocks of starlings (Faulkner et al. 1968, Scott 1968).

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DIMETHYL ANTHRANILATE AS A LIVESTOCK FEED ADDITIVE TO REPEL BIRDS

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ABSTRACT: The effect of the addition of dimethyl anthranilate (DMA) to feedlot rations on the bird bunk activity estimates of starlings (*Sturnus vulgaris*) was evaluated at a commercial Kansas cattle feedlot. Bunk activity estimates were compared using DMA added to the complete ration and DMA added only to the pelleted portion of the ration. Response indicated DMA added to the cattle ration at 0.04% to 0.06% (as fed basis) did not significantly reduce bird numbers. DMA did not significantly affect cattle feed intake.

European starlings and red-winged blackbirds (*Agelaius phoeniceus*) are considered serious economic pests at livestock feedlots (Besser et al. 1967, Feare 1975, 1978, 1981). Damage is particularly severe at cattle feedlots where the ration is presented continuously in long spans of open bunks (Besser et al. 1967). Damage results from feed consumption, feed contamination and the possible spread of

disease (Twedt and Glahn 1982).

Starlings tend to select for the protein pellets and the concentrates in the ration (Crabb 1978). Since these portions are higher in cost than the rest of the ration producers have false conclusions about the cost of feed loss due to birds.

Control efforts have largely focused on chemical toxicants as a means of population control (Besser et al. 1967, Feare et al. 1981). Results using this approach to control depredating starlings have not always been satisfactory (Palmer 1976). Other approaches and feeding practices have been suggested by Twedt and Glahn (1982). They suggested physical separation of the feed from the birds or the use of feeds of a form or size that were not physiologically usable by starlings. There has not been widespread use of these techniques by commercial feedlots.

Mason et al. (1985) reported that dimethyl anthranilate (DMA) will reduce feed consumption by birds when added to livestock rations. DMA is an inexpensive, non-toxic food flavoring approved for human consumption which is offensive to birds even when added to rations at low concentrations (Mason et al. 1983). Present pricing structure of the DMA product prevents feedlot operators from using DMA at levels previously reported to repel birds.

More cost effective methods of utilizing DMA as a feed additive bird repellent need to be evaluated. The following

study evaluated DMA at very low concentrations in cattle rations.

Funds for this research were provided by Ralston Purina Mills, St. Louis, MO., Kansas Livestock Association and Mr. Keith Boone. Personnel at the Denver Wildlife Research Center provided expertise and helpful review of the project. I thank L. R. Corah, J. P. Harner, F. R. Henderson, and J. G. Riley for constructive review and discussion on earlier drafts of this manuscript. Special thanks to Barton County Land and Cattle Company for the use of their feedlot as a research site.

STUDY AREA

The bird activity estimates were made at a 60 ha, 17,000 head capacity cattle feedlot in Barton County, Kansas. The area is characterized by large agricultural cropfields with the principle crops being wheat, sorghum and alfalfa. Some native rangeland can be found in the area. Woodlands in the area consist of black locust (Robinia pseudoacacia) and northern catalpa (Catalpa speciosa) planted on 0.5 to 4 ha tracts. Windbreaks planted around farmsteads and fields to protect against erosion are primarily Siberian elm (Ulmus pumila), eastern redcedar (Juniperus virginiana) and eastern cottonwood (Populus deltoides).

The presence of a 7930 ha marsh 12 km northeast of the feedlot was thought to be a factor associated with the large

flocks of starlings and blackbirds that utilize the feedlot. Another 8400 ha marsh 15 km southeast of the feedlot site is Quivera National Wildlife Refuge.

Flight line counts estimated the starling population to range from 28,000 to 120,000 birds. Observations of roosting sites indicated the starlings using the feedlot were not roosting in the marsh areas. The birds dispersed into smaller flocks and roosted in several woodlands and windbreaks within 10 km of the feedlot.

METHODS

Eight cattle pens of equal size and approximate numbers of crossbred cattle were used as research areas. These sites were randomly selected from an area of the feedlot that had pens of equal size, feed bunk length, cattle numbers, and all cattle were being fed the same ration.

Two of the pens were used as controls with no treatment. The DMA was added to the ration in two different methods. Three pens had the technical DMA starch matrix added to the complete ration as a powder formulation at 0.06% on an as fed basis. The DMA was incorporated into the complete cattle ration at a central milling and mixing facility. Three pens had DMA incorporated into the ration by having pellets surface coated with a DMA lipophyllic starch matrix. The pellets consisted of 68% wheat midds, 23.67% ground corn, 7% molasses, and 1.33% DMA dusted on the

outside of the pellet. These pellets were mixed with corn silage and steam-flaked milo and corn to make a complete cattle ration. The pelleted DMA was fed at the rate of 0.45 kg of pellets per head per day in two feedings of equal size. This calculated to be about 0.045% DMA on an as fed basis.

Bird bunk activity estimates were made by modifying a procedure outlined by Stickley (1979). Two activity estimates were made each observation day. The daylight hours were divided into two intervals 0730-1200 and 1200-1650 and a 0.5 hr observation period was randomly selected within each interval.

Before each estimate the birds were flushed from the feed bunks and counted as they returned or after a 15 minute wait, whichever came first. Bird bunk activity estimates were made by an observer inside a vehicle blind parked within 10 m of the pen under observation.

This study relies on the premise that bird activity at the bunk can be quantitatively related to the amount of feed consumed (Glahn and Otis 1983). All feed bunks were 21.3 m in length.

Data from the bird bunk activity observations within individual pens was pooled thus the pens were used as replicates. Three way analysis of variance (treatment x time of day x week) was used to test for differences among treatments. Differences were assessed by PROC GLM tests (SAS

Inst. Inc., 1986). Statistical significance was set at $P > 0.05$.

Daily observations were made of cattle feed intake. Cattle feed added to the feed bunk was measured by electronic scales mounted on the feed truck. In order to evaluate difference among dates and treatments repeated measure design was used on intake data and analyzed using SAS Institute Inc. (1986).

RESULTS

Starling use of the feedlot was high. Morning flight line counts ranged from 28,000 to 120,000 (mean = 73,250) between 24 November 1987 and 17 December 1987. Mean bird bunk activity was 19.88 entries per minute among all three treatments during the four week trial (Table 1). There was no significant difference among the control and the two types of DMA treatments with respect to mean bird bunk activity ($P = 0.7032$). Time of day did not differ significantly ($P = 0.2055$) with respect to bird bunk activity.

There was a difference among weeks with respect to mean bird bunk activity ($P = 0.0009$). LSD (0.05) analysis show a significant difference between the fourth week and weeks 1, 2, and 3. There was no significant difference between weeks 1, 2, or 3. Week 4 had the highest mean bird bunk activity with 25.49 entries per minute.

Table 1. Estimates of bird bunk entries (per min) in a
Barton Co., Kansas cattle feedlot in 1987.

Treatment	Time	n	Weeks						
			1	2	3	4			
			n	n	n	n			
Control	am	4	18.1	6	18.0	6	22.1	7	24.1
	pm	4	6.9	6	19.3	5	16.7	5	22.4
DMA (Dry)	am	6	21.1	9	12.8	9	21.5	11	29.4
	pm	6	24.6	8	10.6	6	17.9	8	24.1
DMA (Pellet)	am	6	20.7	9	17.3	9	16.7	10	26.3
	pm	6	12.5	9	17.8	6	24.1	9	23.4
Means	am		20.0		16.0		20.1		26.6*
	pm		14.7		15.9		19.6		23.3*

* Means for week 4 differ (P= 0.0009)

Cattle appeared to experience mild neophobia when initially presented with feed treated with DMA added to the complete ration. Analysis showed DMA did not significantly affect cattle feed intake among treatments ($P= 0.1977$) nor was there a significant difference among days ($P= 0.4033$).

DISCUSSION

Starlings were the most frequently observed bird at all feed bunks over the length of the trial. Bird bunk activity estimates increased throughout the trial. Flight line counts indicated an increasing number of birds were using the feedlot near the end of the trial.

DMA treated feed at levels of 0.04% - 0.06% as fed either on the complete ration or on the pellet portion of the ration did not reduce bird bunk activity. Mason et al. (1983) showed that at levels of 0.8-1.6% DMA almost eliminated feed consumption by starlings in a laboratory situation. This research shows DMA treated feed presented at levels currently economically acceptable (i.e., DMA priced at about 10% of the total cost of the ration) did not reduce bird bunk entries. Cattle feed intake levels experienced wide variations (Fig. 1). Analysis showed this was not due to DMA treatment. More research is needed in order to understand the effects DMA will have on cattle performance. Because commercial feedlots are highly cost competitive, any

increases in the cost of the ration must be justified. The results indicate before DMA is useful to reduce feed loss due to birds in a feedlot situation, more cost effective methods of utilizing DMA will have to be developed.

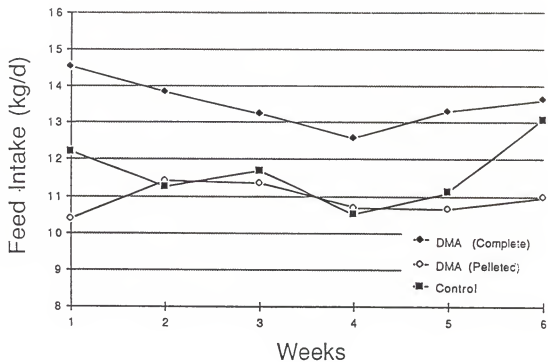


Fig. 1. Feed intake trends for cattle fed ad libitum between 17 November 1987 and 22 December 1987 in Barton County, Kansas.

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Appendix A.

Evaluation of Electric Fence Energizers to Control Birds

Demonstration work conducted in the fall of 1987 evaluated the ability of commercially available fence energizers to kill, stun or prevent starlings from alighting on a wire. A special cable was used that as the birds perched on the cable they completed an electrical circuit between two electrical conductors embedded in the cable. (Avi-away pers. commun.) The cable was connected to an earth return and an energizer. The energizer generates a short pulse of electric energy of moderately high voltage. When the bird alights on the wire he completes the electrical circuit and receives a "memorable" shock (Speedrite pers. commun.).

Starlings were captured using a decoy trap located at the Beef Research Unit in Manhattan, Kansas. Birds were transported and held in groups of 5 in individual cages until used for the trial. Birds were maintained on CO-OP chicken conditioner. Five birds were used for each trial.

Tests were conducted in a 2' x 4' x 8' plywood cage with a wire mesh bottom and an observation window. Birds would perch on the suspended cable in the cage since it was the only available place to roost except for the cage bottom. Birds were flushed initially and at 10 minute intervals

throughout the 30 minute trial. Observations were made of the number of times each individual bird alighted on the wire.

Bird response was variable depending on the type of energizer. Behavior observations indicate that birds when making contact with the energizer would emit fright calls and fly around in the cage. Some birds would be stunned and drop to the bottom of the cage, recover and fly to the cable again. Birds that were stunned would look up at the cable and hop around with wings out-stretched.

Table 2 shows the results of this trial. Energizer performance varied markedly between the commercially available fencers that were used. Performance depends on electrical engineering design and output loads. Fencers used varied from 5,000 v to 10,000 v maximum. For this trial maximum energy was the only feature used to distinguish between energizers.

Table 2. Starling landings on electrified perch in laboratory trials (5 bird groups).

Peak Voltage	0-10 min.	10-20 min.	20-30 min.
5,300 DC	27	3	4
9,700 DC	14	1	0
10,000 DC	16	3	2
120 AC	25	6	0
15,000 AC	9	4	0
Control	70	47	37

The energizers used were not able to kill any birds. Energized wires could reduce the number of times the birds alighted on the wire. This indicates energized wires could be used as a deterrent in some situations. Table 3 lists times to death for birds when they were attached to the wire and then energized. Results indicate electrical contact must be maintained for longer periods of times than originally thought for the results to be fatal.

Evaluation of the results of the trial indicates it may not be possible to control starlings through contact with an energized wire. Starling feet appear to be too well insulated to conduct good electrical impulses. Higher voltages require wider separation of the electrical conductors to prevent arcing. This wide separation enables birds to land on either the hot conductor or the neutral.

Different methods of electrical contact need to be studied if this area is to be pursued. Perhaps having the birds alight in a water source or moistened electrical contacts would increase the effectiveness of the foot-to-foot electrical impulse. With present technology and methods of application, control of starlings does not appear to be feasible with commercially available energizers.

Table 3. Mean length of time (min) to death for starlings
in constant contact with electric perch.

Voltage	n	Time
5,300 DC	5	27.2
9,700 DC	5	24.6
10,000 DC	5	13.6
15,000 DC	5	0.65

Appendix B.

Training Hawks to Patrol Feedlots

Previous research has shown hawks can be trained to control birds. In this research we investigated the use of training raptors to control birds at feedlots.

In the spring of 1987 contact was made with a licensed falconer, Scott Johnson of Milford, Kansas. He had a captive breeders permit to raise prairie falcons (Falco mexicanus) and Harris hawks (Parabuteo unicinctus). It was decided prairie falcons may be too nervous a bird to work in a feedlot type environment, although small birds are a preferred prey in the wild (Clark 1987). Harris hawks would be suitable to train for this project and normally prey on small mammals and some birds. Mr. Johnson reported Harris hawks were easy to train and thought they would be an ideal bird of prey in the confines of a commercial feedlot.

Falconry is not legal in Kansas so special permits were obtained from the Kansas Wildlife and Parks (KWP) and the U.S. Fish and Wildlife Service (USFWS) to allow Scott Johnson and Rick Gulloto, an apprentice falconer, to train and fly hawks for this project.

Two birds were hatched and used for the project. In the early training stages, Scott Johnson's young hawk was maimed and subsequently destroyed after he came in contact with a high voltage electrical transformer. The project was

continued with just one hawk.

Rick Gullato trained his young hawk to attack and kill starlings. While using the bird at a feedlot the bird started to prefer to prey on rats and mice although starlings were in the area. To prevent the choice in prey species Mr. Gullato took his bird to a milo field where blackbirds and starlings were feeding. His hawk pursued these blackbirds but did not catch any. These actions were observed by a KWP employee who reported this activity to the USFWS permit enforcement section.

Subsequently, Mr. Gullato lost his hawk and was fined for violation of permit regulations. His permit stated hawks were to be flown at starlings in a feedlot situation not at blackbirds in crop fields. The trial was then discontinued.

The testing of using live trained hawks to reduce bird problems at feedlots has some merit and potential application. Although the trial was not completed some limitations have been noted. Of primary importance is having falconry become legal in the state of Kansas. If this major obstacle is overcome, permit regulations could ease.

Problems also exist in individual bird behavior. Some hawks refuse to chase starlings and are easily mobbed by large flocks of birds. An aggressive trained falcon is necessary. Several raptors would be needed at each feedlot

in order to keep a hawk in the air at all times. Hawks that circle high above the feedlot area may tend to force pest birds to stay on the ground and in the area.

These limitations may prevent the use of trained raptors from solving the problem with pest birds at feedlots. More information needs to be gathered in order to evaluate the effect of using trained hawks for bird control at feedlots.

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INNOVATIVE TECHNIQUES TO CONTROL BIRD DAMAGE AT FEEDLOTS

by

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Three innovative techniques to control bird damage at feedlots were studied. Dimethyl anthranilate (DMA) was evaluated at low levels in trials involving 542 animals to determine if DMA added to the livestock ration would reduce bird bunk entries. Bird bunk entries are one method of evaluating feed loss due to birds. Estimates were made of the number of birds visiting a 21.3 m feed bunk. These estimates were conducted from 2-4 times per week throughout a 4 week trial. Observations determined that adding dry DMA in a starch matrix to the complete feed ration at 0.06% level as fed did not reduce bird use of the feed bunk. Adding DMA surface-coated onto the pelleted protein portion of the ration and fed at the rate of 0.04% DMA did not reduce bird bunk entries. Some feed neophobia was experienced when cattle were initially exposed to the DMA treated feed. Analysis showed that DMA did not affect cattle feed intake either daily nor throughout the length of the trial. Flight-line counts indicated that the number of birds utilizing the feedlot increased during the length of the trial.

Control of starlings using commercial fence energizers was also evaluated. Data gathered indicated that fence energizers were unable to kill birds when they landed on electrical wires and completed an electric circuit. Voltages varied from 5 kv to 10 kv maximum output. At higher voltages (> 10 kv) wires must be separated by > 25 mm to prevent arcing across contacts. This separation distance permits

birds to land on either wire and not both which is necessary to complete the electrical circuit. Contact with electrical wires will reduce the number of times birds will perch on these wires. Fence energizers are not useful as a lethal bird control device but may have some application in bird control around structures to prevent birds from landing in certain areas.

The use of a trained hawk to reduce birds at feedlots was evaluated. A Harris hawk (Parabuteo unicinetus) was raised and trained to patrol feedlots and kill starlings. Observations were made of the hawk-starling interactions during the early phase of the trial. Based on this limited study Harris hawks are not suitable to scare birds from a feedlot. The hawk was repeatedly mobbed by large flocks of starlings and forced to land. The hawk refused to chase and kill birds. In subsequent hawk training operations the falconer violated federal bird permit regulations and his hawk was removed from the project.

These innovative techniques appeared to be ineffective in controlling bird damage at feedlots. However, some future research needs were identified. More cost effective means of utilizing DMA are required before the commercial feedlot industry will accept the technique. Methods of reducing the cost of DMA such as finding methods to avoid the microencapsulation process may be of some benefit. Other repellent products similar to DMA but less expensive to produce need to be screened for effectiveness. The effect

these feed additives have on cattle performance also need to be evaluated.