

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Proceedings of the Tenth Vertebrate Pest
Conference (1982)

Vertebrate Pest Conference Proceedings
collection

February 1982

REDUCING STARLING DEPREDATIONS AT LIVESTOCK FEEDING OPERATIONS THROUGH CHANGES IN MANAGEMENT PRACTICES

Daniel J. Twedt

U.S. Fish and Wildlife Service, Kentucky Research Station, 334 15th Street, Bowling Green, Kentucky

James F. Glahn

ucky Research Station, 334 15th Street, Bowling Green, Kentucky

Follow this and additional works at: <https://digitalcommons.unl.edu/vpc10>



Part of the [Environmental Health and Protection Commons](#)

Twedt, Daniel J. and Glahn, James F., "REDUCING STARLING DEPREDATIONS AT LIVESTOCK FEEDING OPERATIONS THROUGH CHANGES IN MANAGEMENT PRACTICES" (1982). *Proceedings of the Tenth Vertebrate Pest Conference (1982)*. 46.

<https://digitalcommons.unl.edu/vpc10/46>

This Article is brought to you for free and open access by the Vertebrate Pest Conference Proceedings collection at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Proceedings of the Tenth Vertebrate Pest Conference (1982) by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

REDUCING STARLING DEPREDATIONS AT LIVESTOCK FEEDING OPERATIONS THROUGH CHANGES IN MANAGEMENT PRACTICES

DANIEL J. TWEDT and JAMES F. GLAHN, U.S. Fish and Wildlife Service, Kentucky Research Station, 334 15th Street, Bowling Green, Kentucky 42101

ABSTRACT: Economic losses due to starling depredations at livestock feeding operations can be reduced by implementing management practices that limit access to or reduce consumption of grain products by starlings. Current farm management practices that reduce losses to birds are reviewed and alternate practices suggested. Management practices suggested include physical separation of feed from starlings, use of feed types that reduce the rate of consumption by starlings, and use of feeds that are either unpalatable or not physiologically usable by starlings. The reduction in starling numbers at feedlots resulting from these management practices may alleviate economic losses with a concomitant lesser dependence on shorter-term bird control measures involving scaring or lethal methods.

INTRODUCTION

Economic losses resulting from depredations at livestock feeding operations by wintering concentrations of blackbirds and starlings have been reported in the United States and Great Britain (Palmer 1973, Dolbeer et al. 1978, Feare 1980). Losses can result from feed contamination, disease transmission, and direct feed consumption by birds. However, studies we have conducted in conjunction with livestock specialists at Western Kentucky University indicated little or no adverse affect on feed acceptance, rate of gain, or feed efficiency of calves and swine from feed contaminated with starling fecal matter (Glahn and Stone, unpublished). Indeed, several studies reviewed by Bhattacharya and Taylor (1975) indicated beneficial utilization of fecal wastes by ruminants. Disease transmission via fecal contamination remains an area where potential losses can occur. However, Gough and Beyer (1980) indicated proper management practices may help reduce TGE (transmissible gastroenteritis) related losses to hog producers. Although disease-related losses can be devastating to individual operators, feed consumed by birds appears to be the most important bird-related problem faced by most livestock producers. Quantification of feed losses to birds indicate significant economic losses to livestock producers (Besser et al. 1968, Feare 1975).

The literature on control of problem birds at feedlots has focused primarily on attempts to repel, trap, or kill birds with mechanical devices or chemical agents (Frings 1964, Sprock et al. 1966, Besser et al. 1967, Bogatich 1967, Levingston 1967, West et al. 1967, Feare et al. 1981). Palmer (1976), although suggesting an integrated systems approach to bird control in cattle feedlots, also emphasized scaring or killing birds.

The problem with these approaches is that they fail to create an environment (feedlot) that is less optimal for avian feeding activities, thus allowing rapid reinfestation when these measures are lessened or terminated. We believe that feed losses can be reduced at many livestock feeding operations by limiting the availability of livestock feeds to birds through changes in management practices. A reduction in the availability of feed to birds should result in many long-term benefits including reduced direct livestock feed losses, less chance of disease transmission due to fewer birds, and reduced need for conventional bird control having shorter term effects.

MANAGEMENT PRACTICES

The simplest means of reducing feed losses to starlings, or any other problem bird species, is to make the feed less available for their consumption. Feed can be made less available to starlings by physical separation of feed from starlings, by use of a form, size, or texture of feed that reduces the rate at which feed can be consumed by starlings, and by use of feeds that are either less palatable or that cannot be physiologically used by starlings. Where appropriate, these alternatives may be incorporated into management practices that will lower bird depredations at livestock feeding areas.

Physical Separation of Feed From Birds

All feeds that starlings are able to consume should be stored in "bird-proof" buildings or containers. Spilled, spoiled, or waste feeds should be cleaned up thoroughly and disposed of in a manner that will make them unavailable to starlings.

The best, although probably the costliest, method of preventing starling depredations is to feed livestock in an enclosed bird-proof area. Feeding livestock in bird-proofed buildings has been shown to be beneficial not only in reducing feed losses to starlings but also in improving animal performance. Wright (1973) and Feare and Swannack (1978) found increased weight gain in cattle when fed in bird-proofed areas. Enclosed confinement feeding of swine helps to limit internal parasites, reduces labor costs, and possibly promotes greater feed efficiency (Diggs et al. 1965). Farrowing houses are highly recommended for all hog breeders. These buildings exclude starlings and also provide a moderated environment that reduces the risk of contracting diseases, such as TGE, at an age when pigs are most susceptible.

Enclosure by conventional means (i.e., doors, windows, or screens) may result in an undesirable restriction of animal movements, particularly cattle. To alleviate this, Feare and Swannack (1978) enclosed farm buildings and feeding areas with industrial polyvinyl chloride plastic (PVC) strips. These strips allowed access by livestock, people, and farm machinery while excluding starlings. Feare and Wadsworth (1981) found that simply feeding cattle indoors, even under conditions which did not exclude starlings, significantly lessened starling depredations compared with outdoor feeding.

Livestock operations that involve periodically bringing animals into enclosed buildings (i.e., dairies) should provide for as much supplemental feeding of grain products as possible while animals are indoors. If grain products must be fed outdoors, several management practices are available that can reduce feed losses to starlings. Feeds can be offered in self-feeders or automatic feeders. Flip-top self-feeders are commonly used to feed swine out-of-doors. These feeders protect feed from the elements as well as birds, but must be vigilantly maintained to prevent the flip-tops from being bent, dislodged, or lost. Self-feeders should be concentrated at a few sites, thus limiting sources for potential depredation. If birds are to be baited or scared, the limited number of feeding sites should allow for more effective control of problem birds.

Canvas or PVC strips, suspended around feed troughs so that they can be pushed aside by feeding animals and return to their original position when animals are not feeding, could limit starling access to livestock feeds. Automatic, magnetic, or electronic release feeders have been used successfully for outdoor feeding of dairy cattle. These feeders dispense small amounts of supplemental grain products to individual cows throughout the day, thus greatly limiting exposure time to starlings. Additionally, some of these feeders can be set to deliver different amounts of feed to individual cows based on that individual's nutritional requirements or production (Frobish et al. 1978, Owen et al. 1978). Although the previous methods require a certain amount of capital expenditures, there are less costly practices which may reduce damage but not as effectively.

Feed should be placed in raised troughs rather than on the ground or on a feeding floor. Placement of feed in raised troughs presents less feeding space for starlings. Feare and Inglis (1979) showed decreased starling feeding rates resulting from limited feeding space. Additionally, raised troughs reduce waste and promote greater feed efficiency (Braude and Rowell 1966). Further, our studies indicate that feeding on the ground appears to be associated with larger numbers of blackbirds utilizing the feed source (Glahn, unpublished). Any feeding schedule that reduces the duration of diurnal feed exposure will probably reduce starling depredations. As starlings forage only during the daylight hours, feeding livestock in the late afternoon or evening will limit the time feed is exposed to starlings. Cattle fed at night, however, have shown slower weight gain (Crabb 1978). Therefore, livestock producers may wish to limit this option to periods when high numbers of birds are present. It is often desirable to limit the ration offered to boars and gestating sows. Gough and Beyer (1980) suggested that limited rations could be offered in the evening or larger amounts could be fed every other day with no feed offered during the interval. An alternating feeding schedule would force starlings to feed elsewhere on days with no feed exposure, and these birds would be less likely to continue to use the intermittent food source.

Feed Forms

The form or size of the feed offered can greatly affect consumption by starlings. Liquid feeds as a complete ration or as a major portion of the diet have been fed experimentally to swine and have proven equal or superior to dry feeds (Braude and Rowell 1967, Kornegay et al. 1981, Forbes and Walker 1968). Wornick (1969) indicated losses to birds are minimized when feeding liquid supplements. Finely ground grain products as well as other protein and carbohydrate sources (i.e., molasses, soluble distillers grain, or condensed whey solubles) can be incorporated into liquids or gels (Fonnesbeck et al. 1975, Whalberg and Cash 1979) and fed by lick-wheel feeders. Lick-wheel feeders not only have the advantage of liquid feeds but they also limit the surface area exposed to starlings. Liquids can also be added to silage or hay while feeding these rations. Lick-blocks (i.e., mineral or salt blocks) can also be used to deliver smaller amounts of concentrated rations.

Glahn and Otis (1980) found free-ranging starlings consumed 3/16 inch diameter pig pellets at a rate more than eight times greater than granular hog meal. The granular meal did, however, attract starlings to the feed site and daily consumption of this meal could be economically significant. Using captive starlings, we have confirmed that consumption of granular meal was significantly less ($P < 0.01$) than consumption of 3/16 inch diameter pellets. Consumption by starlings of 1/2 inch diameter pellets, however, was significantly less ($P < 0.01$) than consumption of granular meal (Twedt and Glahn, unpublished). Based on these findings, if accessible to starlings, grain products should be fed as large pellets or cubes ($\geq 1/2$ inch diameter), liquids, or less desirably, granular meal.

Feed mills, designed for use by individual feedlot operators, can chop and mix a complete ruminant ration, including hay, silage, grain, and additives. Incorporation of grain into feed rations by this method should reduce its availability to starlings.

Unpalatable or Unutilizable Feeds

Roughages supply the bulk of any ruminant's diet during the winter months. Dried hay (grass, clover, or alfalfa) are excellent feeds that have no bird depredation problems. Silage constitutes the bulk of the ration fed at most dairy operations. Corn silage is by far the best silage product currently available and provides a high-quality feed, high yields per acre, an efficient use of labor at harvest and ensiling, and has excellent animal acceptance. However, our studies suggest corn silage can attract birds to feed sites. Placing grain or grain products on top of silage rations (top dressing) to increase acceptance by livestock appears to exacerbate this problem (Glahn, unpublished).

If the number of starlings attracted to the feedlot by corn silage is unacceptably high, there are alternate silage products available. Dairy operators should consult with local agricultural specialists before using some of these silages as they may require increased carbohydrate sources or may reduce milk yields. Haylage (nongrain silage) made from alfalfa is probably the most attractive alternative to corn (Baxter et al. 1968). Alfalfa haylage is high yielding, high quality, and well accepted by livestock. Alfalfa, however, must be cut and ensiled three or four times yearly versus only once for corn silage. Other high-quality, high-yielding haylages such as sorghum x sudan grass hybrids have been fed to dairy cattle with favorable results (Montgomery et al. 1966) and could be incorporated into a balanced feeding program.

Bird-resistant grains, such as some sorghum varieties, may be used as silage. Bird-resistant grains have properties that make them less susceptible to bird damage while maturing. Although no research has been conducted on the bird resistance of ensiled products, some of these properties are thought to be retained when the crop is ensiled. There appears to be a decreased acceptance of bird-resistant silage by dairy cattle (Culvahouse et al. 1975). Therefore, economic considerations must be fully addressed before the use of such silage.

Crop residues and agri-industry by-products as ruminant feed sources have not been adequately exploited. Although acceptance by livestock of many crop residues is poor, there are large quantities available that may be fed inexpensively and with little or no bird depredation. Walker et al. (1976, as cited by Anderson 1978) estimated over 71 million metric tons of cereal crop residues are produced, and Miller et al. (1979) estimated 56 million tons of soybean residues are produced annually in the U.S. Crop residues such as corn stalks, soybean and peanut hulls, or wheat chaff can be either grazed in the field or collected and fed as hay-like materials. Ensiling or pelletizing crop residues to increase acceptance and utilization by livestock has yielded mixed results but further study is required (Gupta and Johnson 1978, Gupta et al. 1978, Miller et al. 1979).

Agri-industry by-products such as bagasse (Marshall 1972), vegetable or fruit residues (Kirk and Koger 1970), pulp and paper (Millett et al. 1973, Butterbaugh and Johnson 1974), and dairy-industry wastes (Rogers et al. 1977), Crickenberger et al. 1981) are all potential feedstuffs where sources of supply are available. Many of these products are unacceptable as food sources for starlings but can be incorporated as high-quality feedstuffs into an integrated livestock-feeding system. By-products and residues can be pressed into large pellets or cubes to reduce bird depredations on feeds acceptable to starlings, while possibly increasing acceptance and utilization by livestock (Ott et al. 1979).

Roughage diets must be supplemented with additional protein and carbohydrates. High-protein supplements made from soybean meal and cereal grains or corn are generally offered either free-choice or in different amounts based on an individual animal's nutritional requirements or performance. High-protein supplements are expensive and losses to birds can adversely impact a feedlot operator both in actual feed losses and in decreased animal performance. Unfortunately, high-protein supplements are the feed source most vulnerable to starling depredations (Crabb 1978).

An alternate protein source for ruminants is nonprotein nitrogen (NPN). NPN sources include: urea, biuret, anhydrous ammonia, diammonium citrate, and other nitrogen-containing molecules. As a source of protein, animal fecal matter can also be grouped with NPN sources. NPN studies have been summarized by Reid (1953), Briggs (Ed.) (1967), and Fommesbeck et al. (1975), whereas Bhattacharya and Taylor (1975) reviewed studies on animal fecal matter. Many NPN-containing rations are available commercially and, although prices vary, they generally are lower than traditional vegetable protein sources. Most NPN sources, however, can be toxic and feed rejection can occur if fed improperly or at high levels. Numerous studies on wintering ruminants have indicated NPN sources are highly beneficial. Fecal materials such as poultry wastes (Smith et al. 1979), Cullison, et al. 1976), swine manure (Berger et al. 1981), and cattle manure (Harpster et al. 1978, Richter et al. 1980) have been incorporated into livestock feeds, generally with beneficial results. The disease and health problems associated with feeding fecal materials, however, have not been adequately documented. On the other hand, NPN and fecal matter utilization by poultry, and presumably, starlings, has been determined to be of little nutritional value (Chavez et al. 1966, Moran et al. 1967, Flegal and Zindel 1969, Reid et al. 1972, Kazemi and Balloun, 1973, Sloan and Harms 1973, Trankulchang and Balloun 1975).

SUMMARY

Starling depredations at livestock feeding areas can be reduced by implementing appropriate management practices. These practices include the exclusion of starlings from feed sources by enclosed buildings, enclosed or reduced access self-feeders, and automated (amount-limiting) feeders. Losses can also be reduced by limiting the rate at which starlings are able to consume exposed feed. Depredations can be reduced by feeding large pellets or cubes, liquid feeds or supplements, lick-blocks, or less desirably, ground meal. Limiting the surface area of exposed feed with lick tanks, raised feed troughs, or partially enclosed feeders can also reduce losses. The use of feedstuffs which are inedible or not nutritionally useful for starlings is beneficial. These feeds include hays, haylages, nonprotein nitrogen sources, and bird-resistant silages. When grain products are fed with silages, they should be ground and thoroughly mixed with the silage; silage should not be "top-dressed" with grain. Grain products should be fed indoors if possible. When fed outdoors, they should be fed in a "bird-resistant" form.

ACKNOWLEDGEMENTS

We thank the staff of the Kentucky Research Station for their assistance in field research and manuscript preparation. Additionally, the cooperation of Western Kentucky University Experimental Farm

personnel, various county agricultural extension specialists, and numerous Tennessee livestock producers is gratefully acknowledged.

LITERATURE CITED

- ANDERSON, D.C. 1978. Use of cereal residues in beef cattle production systems. *J. Anim. Sci.* 46(3): 849-861.
- BAXTER, H.D., M.J. MONTGOMERY, and J.R. OWEN. 1968. Comparison of RS610 grain sorghum, corn and alfalfa-orchardgrass as silages for lactating cows. *Tennessee Farm and Home Science* 66:2-4. [Abstract in 1967 *J. Dairy Sci.* 50(4):615-616.]
- BERGER, J.C.A., J.P. FONTENOT, E.T. KORNEGAY, and K.E. WEBB, JR. 1981. Feeding swine waste. I. Nitrogen utilization, digestibility and palatability of ensiled swine waste and orchardgrass hay or corn grain fed to sheep. *J. Anim. Sci.* 52(6):1404-1416.
- BESSER, J.F., J.W. DEGRAZIO, and J.L. GUARINO. 1968. Costs of wintering starlings and red-winged blackbirds at feedlots. *J. Wildl. Manage.* 32:179-180.
- _____, W.C. ROYALL, JR., and J.W. DEGRAZIO. 1967. Baiting starlings with DRC-1339 at a cattle feedlot. *J. Wildl. Manage.* 31:48-51.
- BHATTACHARYA, A.N. and J.C. TAYLOR. 1975. Recycling animal waste as a feedstuff: A Review. *J. Anim. Sci.* 41(5):1438-1457.
- BOGATICH, V. 1967. The use of live traps to remove starlings and protect agricultural products. *Proc. 3rd Vert. Pest Conf.*, San Francisco, California. 3:98-99.
- BRAUDE, R. and J.G. ROWELL. 1966. Comparison of meal and pellets for growing pigs fed either in troughs or off the ground. *J. Agric. Sci., Camb.* 67:53-57.
- _____. 1967. Comparison of dry and wet feeding of growing pigs. *J. Agric. Sci., Camb.* 68:325-330.
- BRIGGS, M.H. (Ed.) 1967. Urea as a protein supplement. Pergamon Press. 460pp.
- BUTTERBAUGH, J.W. and R.R. JOHNSON. 1974. Nutritive value of acid hydrolyzed wood residue in ruminant rations. *J. Anim. Sci.* 38(2):394-403.
- CHAVEZ, R., J.M. THOMAS, and B.L. REID. 1966. The utilization of non-protein nitrogen by laying hens. *Poultry Sci.* 45:547-553.
- CRABB, A.C. 1978. Bird damage research at the University of California, Davis. *Proc. 8th Vert. Pest Conf.*, Sacramento, California. 8:36-39.
- CRICKENBERGER, R.G., H.E. HENDERSON, and C.A. REDDY. 1981. Fermented ammoniated condensed whey as a crude protein source for feedlot cattle. *J. Anim. Sci.* 52(4):677-687.
- CULLISON, A.R., H.C. MCCAMPBELL, C.A. CUNNINGHAM, R.S. LOWREY, E.P. WARREN, B.D. MCLENDON, and D.H. SHERWOOD. 1976. Use of poultry manures in steer finishing rations. *J. Anim. Sci.* 42(1):219-228.
- CULVAHOUSE, E.W., B.R. HATHCOCK, and M.J. MONTGOMERY. 1975. A comparison of corn, bird resistant, and non-bird resistant grain sorghum silages for lactating cows. *Tennessee Farm and Home Sci.* 93:34-35.
- DIGGS, B.G., B. BAKER, JR., and R.W. ROGERS. 1965. Influence of protein level and confined feeding on performance and carcass characteristics of swine. *J. Anim. Sci.* 24:283.
- DOLBEER, R.A., P.A. WORONECKI, A.R. STICKLEY, JR., and S.B. WHITE. 1978. Agricultural impact of a winter population of blackbirds and starlings. *Wilson Bull.* 90(1):31-44.
- FEARE, C.J. 1975. Cost of starling damage at an intensive animal husbandry unit. *Proc. 8th Br. Insecticide and Fungicide Conf.* pp. 253-260.
- _____. 1980. The economics of starling damage. IN *Bird Problems in Agriculture* (ed. E.N. Wright, I.R. Inglis and C.J. Feare). pp. 39-55. British Crop Protection Council, London.
- _____, and I.R. INGLIS. 1979. The effects of reduction of feeding space on the behaviour of captive starlings (*Sturnus vulgaris*). *Ornis Scandinavica* 10:42-47.
- _____, A.J. ISAACSON, P.A. SHEPPARD, and J.M. HOGAN. 1981. Attempts to reduce starling damage at dairy farms. *Protection Ecology* 3:173-181.
- _____, and K.P. SWANNACK. 1978. Starling damage and its prevention at an open-fronted calf yard. *Anim. Prod.* 26:259-265.
- _____, and J.T. WADSWORTH. 1981. Starling damage on farms using the complete diet system of feeding dairy cows. *Anim. Prod.* 32:179-183.
- FLEGAL, C.J. and H.C. ZINDEL. 1969. The utilization of poultry waste as feedstuff for growing chicks. *Res. Rep.* 117:21-28. Michigan State University, East Lansing, Michigan.
- FONNESBECK, P.V., L.C. KEARL, and L.E. HARRIS. 1975. Feed grade biuret as a protein replacement for ruminants, a review. *J. Anim. Sci.* 40(6):1150-1184.
- FORBES, T.J. and N. WALKER. 1968. The utilization of wet feed by bacon pigs with special reference to pipe-line feeding. *J. Agric. Sci., Camb.* 71:145-151.
- FRINGS, H.F. 1964. Sound in vertebrate pest control. *Proc. 2nd Vert. Pest Conf.*, Anaheim, California. 2:50-56.
- FROBISH, R.A., K.E. HARSHBARBER, and E.F. OLVER. 1978. Automatic individual feeding of concentrates to dairy cattle. *J. Dairy Sci.* 61:1789-1792.
- GLAHN, J.F. and D.L. OTIS. 1980. An approach for assessing feed loss damage by starlings at livestock feedlots. *Proc. 3rd ASTM Symposium on Test Methods for Vertebrate Pest Control and Management Materials.* Fresno, California, pp. 38-45.
- GOUGH, P.M. and J.W. BEYER. 1980. Study of the relationship between birds and TGE (transmissible gastroenteritis) disease of swine. Final report: U.S. Fish and Wildlife Service Contract No. 14-16-0009-78-039.
- GUPTA, B.S. and D.E. JOHNSON. 1978. Energy partitioning and nitrogen balance of sheep fed soybean straw diets. *J. Anim. Sci.* 46(5):1326-1331.
- _____, and F.C. HINDS. 1978. Soybean straw intake and nutrient digestibility by sheep. *J. Anim. Sci.* 46(5):1086-1090.

- HARPSTER, H.W., T.A. LONG and L.L. WILSON. 1978. Comparative value of ensiled cattle waste for lambs and growing-finishing cattle. *J. Anim. Sci.* 46(1):238-247.
- KAZEMI, R. and S.L. BALLOUN. 1973. Urea and diammonium citrate for laying hens. *Poultry Sci.* 52:44-50.
- KIRK, W.G. and M. KOGER. 1970. Citrus products in cattle finishing rations. *Florida Agr. Exp. Sta. Bull. No. 739.*
- KORNEGAY, E.T., H.R. THOMAS, D.L. HANDLIN, P.R. NOLAND, and D.K. BURBANK. 1981. Wet versus dry diets for weaned pigs. *J. Anim. Sci.* 52(1):14-16.
- LEVINGSTON, P.E. 1967. Winter starling control with DRC-1339. *Proc. 3rd Vert. Pest Conf., San Francisco, California.* 3:100-103.
- MARSHALL, S.P. 1972. Sugarcane bagasse pellets and cottonseed hulls as roughage sources in complete rations. *J. Dairy Sci.* 55(3):398.
- MILLER, B.L., G.C. FAHEY, JR., R.B. RINDSIG, L.L. BERGER, and W.G. BOTTJE. 1979. In vitro and in vivo evaluations of soybean residues ensiled with various additives. *J. Anim. Sci.* 49(6):1545-1550.
- MILLER, M.P., R.W. HARVEY, E.R. BARRICK, and A.C. LINNERUD. 1979. Effect of readily available carbohydrate and roughage source on performance of lambs and steers fed a liquid supplement. *J. Anim. Sci.* 49(6):1552-1558.
- MILLETT, A., J. BAKER, L.D. SATTER, J.N. MCGOVERN, and D.A. DINIUS. 1973. Pulp and paper-making residues as feedstuffs for ruminants. *J. Anim. Sci.* 37(2):599-605.
- MONTGOMERY, M.J., B.J. BEARDEN, and J.R. PLUMMER. 1966. Summer annuals for hay and silage. *Tennessee Farm and Home Sci. Oct-Dec 1966:5-7.*
- MORAN, E.T., JR., J.D. SUMMERS, and W.F. PEPPER. 1967. Effect of nonprotein nitrogen supplementation of low protein rations on laying hen performance with a note on essential amino acid requirements. *Poultry Sci.* 46:1134-1143.
- OTT, E.A., J.P. FEASTER, and SANDILIEB. 1979. Acceptability and digestibility of dried citrus pulp by horses. *J. Anim. Sci.* 49(4):983-987.
- OWENS, M.J., L.D. MULLER, J.A. ROOK and F.C. LUDENS. 1978. Evaluation of magnetic grain feeder for lactating dairy cows. *J. Dairy Sci.* 61:1590-1597.
- PALMER, T.K. 1973. The house finch and starling in relation to California's agriculture. In Kendeigh, S.C.; Pinowski, J. (Eds) *Productivity, population dynamics and systematics of granivorous birds.* Warsaw; Polish Scientific Publishers, pp. 275-290.
- _____. 1976. Pest bird damage control in cattle feedlots: The Integrated Systems Approach. *Proc. 7th Vert. Pest Conf., Monterey, California.* 7:17-21.
- REID, B.L., A.J. SVACHA, R.L. DORFLINGER, and C.W. WEBER. 1972. Non-protein nitrogen studies in laying hens. *Poultry Sci.* 51:1234-1243.
- REID, J.T. 1953. Urea as a protein replacement for ruminants: a review. *J. Dairy Sci.* 36:955-996.
- RICHTER, M.F., R.L. SHIRLEY, and A.Z. PALMER. 1980. Effect of roughage fraction of cattle manure on digestibility and net energy of feedlot diets fed steers. *J. Anim. Sci.* 50(2):207.
- ROGERS, G.F., J.G. WELCH, K.M. NILSON, and A.M. SMITH. 1977. Digestibility of liquid whey by steers and cows. *J. Dairy Sci.* 60:1559-1562.
- SLOAN, D.R. and R.H. HARMS. 1973. The effect of incorporating hen manure into the diet of young chicks. *Poultry Sci.* 52:803-805.
- SMITH, O.B., G.K. MACLEOD, D.N. MOWAT, and E.T. MORAN, JR. 1979. Effect of feeding organic acid treated hen excreta upon performance, carcass merit and health of feedlot cattle. *J. Anim. Sci.* 49(5):1183.
- SPROCK, C.M., T.K. PALMER, and A. ZAJANC. 1966. Use of sonic devices in starling control. *Prog. Rep. on Starling Control Research 1966.* Univ. Calif. Agric. Exp. Sta., Davis, California.
- TRANKULCHANG, N. and S.L. BALLOUN. 1975. Non-protein nitrogen and growing chickens. *Poultry Sci.* 54:591-594.
- WALHBERG, M.L. and E.H. CASH. 1979. Various liquid by-products as a protein supplement to ruminant diets. *J. Anim. Sci.* 49(6):1431-1437.
- WALKER, H.G., JR., G.O. KOHLER, R.P. GRAHAM, M.R. HART, and W.N. GARRETT. 1976. Upgrading cereal straws. *Proc. 9th National Conf. on Wheat Utilization Research. ARS-NC-40.* (Article not seen.)
- WEST, R.R., J.F. BESSER, and J.W. DEGRAZIO. 1967. Starling control in livestock feeding areas. *Proc. 3rd Vert. Pest Conf., San Francisco, California.* 3:89-93.
- WORNICK, R.C. 1969. Liquid supplements for livestock feeding. *Chas. Pfizer and Co., Inc. New York, New York.* pp. 91.
- WRIGHT, E.N. 1973. Experiments to control starling damage at intensive animal husbandry units. *O.E.P.P./E.P.P.O. Bull.* 9:85-89.