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PROTECTING FIELD CROPS FROM WATERFOWL DAMAGE BY MEANS
OF REFLECTORS AND REVOLVING BEACONS

By F. M. Uhler, Biologist, Section of Food Habits, Division of Wildlife Research, and Stephen Creech, Game Management Agent, Division of Game Management.

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Waterfowl occasionally damage cultivated crops in many parts of the United States, but under normal conditions these birds are an important wildlife asset, and therefore everything possible should be done to conserve an adequate supply. While their damage must be controlled, it is best done by methods that are not destructive to the birds. In fact, destructive action, other than shooting in accordance with the regulations during the open season, can be legally taken only under permit from the Bureau of Biological Survey. A leaflet (BS-13), issued by the Survey in 1935, entitled "Protecting Grain Crops from Damage by Waterfowl," discusses the nature of the damage and presents suggestions for protecting crops. The present leaflet is intended as supplement, particularly to recommend measures for the protection of field crops without destroying the birds.

PROTECTIVE EXPERIMENTS

Buckwheat in Michigan

During the fall of 1938, experiments in protecting crops were conducted in buckwheat fields adjacent to Saginaw Bay, Mich., where damage by shallow-water ducks, particularly black ducks (*Anas rubripes*), had been severe. These experiments were based upon a combination of methods that had previously been successfully used in large rice fields in Arkansas County, Ark., to protect the ripened crop against nocturnal depredations by mallards (*A. platyrhynchos*), and in lettuce fields along the Columbia River near Kennewick, Wash., to prevent damage by baldpates (*Mareca americana*).

Rice Fields in Arkansas

In the Arkansas rice fields large numbers of mallards had been feeding at night on the domestic rice. These depredations were reported to have been stopped by the use of a moving beam from an automobile headlight mounted on the frame of an oscillating electric fan and placed on top of a 15-foot wooden tower. This equipment could be used only where a power line was available to supply the current. In that region power was usually available, however, because many of the rice fields were equipped with electric pumps.

Lettuce Fields in Washington

The damage by baldpates to lettuce fields in Washington was prevented by the use of reflectors made from 7-inch squares of shining sheet metal, each piece being suspended by a buckskin thong tied to a split ring on one corner. The reflectors were suspended in pairs about 2 feet off the ground, from T-shaped cross bars placed at favorable points, the thongs being cut long enough to permit the squares to twist and swing in the breeze. The sunlight reflections were reported to have frightened away all ducks that attempted to alight in the fields. In small fields ordinary kerosene lanterns were placed near the center to make the reflectors effective at night.

Damage by Ducks to Field Crops in Michigan

The greater proportion of damage by waterfowl in grainfields occurs after the grain has been cut, frequently after it is shocked, and is most severe during rainy seasons when excessive moisture delays threshing.

Along the southeast side of Saginaw Bay, Mich., during the autumn of 1937, black ducks were reported to have completely destroyed the buckwheat crop in certain fields where the harvest had been delayed. With the approach of the harvest season of 1938, black ducks again concentrated along Saginaw Bay and began to feed, first on the barley and later on buckwheat. Most of the fields in that vicinity range from about 4 to 15 acres in extent. A buckwheat field with an area of a little less than 10 acres was selected for the first experiment, because its crop had been entirely destroyed after the preceding season's cutting, and the ducks had again begun to feed in it more extensively than in any of the surrounding fields. They were permitted to feed there in considerable numbers for 3 days before any frightening devices were installed in order to provide a thorough test of the effectiveness of the devices. During the preceding harvest season the firing of shotguns had failed to drive the birds from this field and they had learned to keep out of range soon after the opening of the hunting season.

The ducks would begin to arrive in the fields about half an hour before sunset, but the bulk of the feeding was done at twilight during the course of these experiments. In former years feeding also was reported to have occurred on moonlight nights. In the morning the ducks would fly to the fields at dawn and continue feeding until shortly after sunrise, after which they would retire to adjacent marshes or open bays. Each of these two feeding periods lasted about an hour. The arrival of the larger flocks was almost always preceded

by a period of "scouting," when a single bird or small flocks would circle the fields a number of times before dropping in to begin feeding.

CONSTRUCTION AND USE OF DETERRENTS

Spinner Reflectors

The feeding habits described made it necessary to install frightening devices that would be effective both day and night. For this reason "spinner reflectors" were placed on cross bars at intervals of 35 to 40 yards throughout the field, with a revolving beacon at the center for use after dark. The beacon and the reflectors were constructed so that they would rotate freely in the slightest breeze.

It was found of the utmost importance to space the cross bars evenly, so as to make it impossible for a duck to alight in the field at a greater distance than 25 to 30 yards from any pair of reflectors. It was also found desirable to suspend each pair of reflectors by cords of different lengths (fig. 1, B) to insure irregularity of motion, which is necessary to prevent the birds from becoming accustomed to these devices.

Suitable reflectors can be made from almost any tin-plated sheet metal that can be cut in pieces about 10 to 12 inches square. The upper edge should be folded over 1 inch to give added strength and rigidity. Discarded 5-quart oil cans are satisfactory and easily obtained. From three such cans enough reflectors can be made to protect an acre of grain. The ends are removed with a rotary can opener and then the sides are cut with tin shears into two pieces, each about 11 by 12 inches. A small hole is punched through the center of the doubled edge and the reflector bent in the form of an open "S" to catch the breeze (fig. 1, A and B). A strong steel swivel (fig. 1, B) is wired to this hole, bronze swivels being too soft and soon wearing out. Small chain swivels also are satisfactory. All swivels should be lubricated to reduce wear and insure continuous spinning. Pieces of heavy braided cord, similar to that used on venetian blinds, are cut and tied to the swivels to suspend the reflectors from T-shaped supports. Ordinary twisted cord is unsuitable because it soon wears out. The cords should be long enough for the top of one reflector in each pair to be about 6 to 8 inches below the cross bar, and the other about 12 to 14 inches below it (fig. 1, A).

The upright post of each T-bar should project 4 to 4-1/2 feet above ground. Suitable wooden posts can be made from 2-inch square material cut in 5-1/2-foot lengths so that they can be driven 1 to 1-1/2 feet into the ground. The cross bars can be made from 1-by 2-inch wooden strips cut in lengths of about 3-1/2 feet and fastened near the top of the posts by four strong nails.

The T-supports with their attached pairs of reflectors are placed 35 to 40 yards apart in regular rows, the outside rows 20 yards in from the edge of the field. The importance of completely covering all parts of the field cannot be overemphasized. In isolated places, where the birds tend to alight first, it may be helpful to put an occasional extra pair of reflectors midway between the regular pairs.

Revolving Beacons

Where damage to crops is done at night, a revolving beacon, rotated by air currents, can be easily constructed. This is made by bolting six curved sheet-metal wings (made from the sides of 1-quart tin cans) equally spaced on the rim of a front bicycle wheel (fig. 1, C). Two 1/2-inch-long stove bolts and a small strip of tin about 1 by 3-1/2 inches, punched about 1/2 inch from each end with a hole large enough for a stove bolt, can be used to attach the wings. Each wing is punched with three holes, two for insertion of the stove bolts and one at the opposite end for fastening a reinforcing wire, as shown in the illustration. The small tin strip is bent around the back of the wheel rim opposite the base of each wing, as illustrated, so that when the bolts are inserted and tightened it will serve as clamp for anchoring the wing.

Where there is not enough wind to revolve the beacons, a small electric fan, like that used in automobiles, can be so mounted near the beacon that it will blow against the wings and make the wheel revolve. These fans can be operated from 6-volt storage batteries that can be recharged at low cost. They should be sheltered at the top and sides against damage by rain or snow. The wheel is mounted in a horizontal position on top of a 1-inch iron pipe that has been driven into the ground near the center of the field. Mounting can be readily accomplished by using a 1-inch pipe cap (fig. 1, E) with a hole drilled in the center (fig. 1, F). This hole should be just large enough to permit the wheel's axle to be inserted and securely fastened with a nut. Usually a pipe 6-1/2 feet long, driven 2 feet into the ground, is suitable, but if the soil is soft a longer pipe or guy-wire supports may be needed. A pipe cap should be placed on the upper end of the pipe before driving to prevent damage to the threads. The wheel bearings should be thoroughly lubricated. The speed of rotation can be regulated by tightening or loosening the cones on the axle.

Two small electric reflecting lanterns are mounted back to back on a wooden block by screws through holes punched in the base flanges. This block, made of 2-by-6-inch soft wood, cut 9 to 10 inches long, is fastened on top of the center of the bicycle wheel by means of four 2-1/2-inch eyebolts equipped with wing nuts (fig. 1, D). The "eyes" should be opened slightly with a cold chisel so that each can be hooked over the intersecting point of two of the wheel spokes (fig. 1, C). A hole about 3/4 inch in diameter should be drilled at the center of the block to accommodate the projecting upper end of the wheel's axle. Four smaller holes, just large enough for the eyebolts, should be drilled near the corners of the block so that the bolts can fasten it tightly to the wheel, as shown in the illustration.

Inexpensive electric lanterns using dry-cell batteries that give 80 to 100 hours' service and throwing an 800-foot beam are satisfactory for small fields. If operated only when needed, usually for about an hour after sunset and an hour before sunrise, the operating cost is small. Fields more than 1,200 feet wide will require several beacons.

When the lanterns shone on the spinning reflectors after dark the resulting flashes frightened all ducks away from the fields. The effectiveness of the reflectors continued throughout the entire harvesting season. By day the spinner reflectors alone were sufficient to protect the crops completely.

Costs

Revolving beacons like that here described can be constructed at a cost of about \$5 each. If waste lumber or woodland poles are available for the T-supports and if the spinner reflectors can be made as described the cost will be largely dependent on the price of the swivels. The buck-wheat fields in Michigan were equipped with reflectors at a cost of about 50 cents an acre, and the swivels, which were the only items of appreciable cost, lasted several seasons.

FIGURE 1.--SPINNER REFLECTOR AND REVOLVING BEACON.

A. T-bar, made by nailing a $3\frac{1}{2}$ -foot cross bar to a small post, projecting $4\frac{1}{2}$ feet above the ground, equipped with a pair of sheet-metal reflectors, bent so as to revolve in the breeze. **B.** Lubricated steel swivel, for attaching heavy braided cord to doubled edge of reflector. **C.** Bicycle wheel equipped with six curved sheet-metal wings and two lanterns mounted on wooden block. **D.** $2\frac{1}{2}$ -inch eyebolt with wing nut, for attaching lantern block to wheel. **E.** Pipe cap, for mounting wheel to a $6\frac{1}{2}$ -foot, 1-inch pipe driven 2 feet into the ground. **F.** Top view of pipe cap showing hole for inserting wheel axle.