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Controlling Quelea Damage to Small Grains in Africa with Methiocarb

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ABSTRACT

Quelea (Quelea quelea) damage to ripening grain crops in Africa is considered to be one of the world's most serious vertebrate pest problems. Many African countries affected by quelea have control teams or organizations actively combating the problem. Considerable progress has been made by these different groups in some aspects; however, large-scale campaigns to reduce quelea populations with toxic chemical sprays have provided only limited relief from depredations. Furthermore, chemical sprays are costly and potentially hazardous. To be useful, a control method must be economical, effective, safe, and highly selective for the depredating species. The chemical bird repellent "methiocarb" has largely satisfied these criteria and has been demonstrated to be an effective chemical in protecting many kinds of crops from bird damage in the United States.

Initial field tests with methiocarb conducted in Kenya and Tanzania on ripening wheat and rice indicated effectiveness, but more critical studies are needed. Laboratory tests have shown that caged quelea are highly sensitive to the chemical.

INTRODUCTION

Bird damage to crops, particularly cereal grains, is a serious problem all over the world. Countries with highly developed agricultural technology have spent considerable effort in solving bird damage problems, but in less-developed countries which have not had the resources to devote to such programs, birds can severely limit agricultural production.

The U.S. Fish and Wildlife Service (FWS) is one of the principal Federal agencies responsible for developing methods to alleviate bird damage problems throughout the United States. Since 1968, the Denver Wildlife Research Center (DWRC), under the FWS, has worked with several international organizations to help alleviate similar problems in developing countries. Under an agreement with the U.S. State Department's Agency for International Development (AID), DWRC biologists have investigated the kinds and amounts of bird damage to crops in Africa, Latin America, and Southeast Asia.

In Africa, the most serious problem bird is the subtropical red-billed weaver (Quelea quelea), a sparrow-sized bird of the weaver finch family. The quelea has the distinction of being the most numerous, and perhaps the most destructive, bird in the world. For example, Doggett (1970) estimated

that between 600,000 to over 1 million tons of small grains are lost annually in Africa, and Haylock (1960) stated that more than 330 million quelea were destroyed in Kenya and Tanzania between 1956 and 1960. Several billion quelea range over about 5 million square kilometers (20 percent of the African continent) and affect the economies of approximately 25 nations. The birds' natural foods are weed and grass seeds, but when these become scarce because of drought or other factors, quelea can cause enormous damage to local cereal crops--primarily rice, millet, sorghum, and wheat (Crook and Ward, 1968; De Grazio and Besser, 1974).

Since about 1950, various international organizations have provided African nations with assistance on the quelea problem. Beginning in 1971, AID has supported quelea research through an agreement with DWRC. Personnel of the DWRC, from considerable experience with agricultural bird problems in the United States, have concluded that the most productive approach to such problems is protection of the fields actually being damaged, rather than the removal or destruction of damaging birds. Consequently, the techniques and chemicals that have proved most effective for crop protection in the United States are being investigated for quelea.

Preliminary work on problem assessment and evaluation of selected chemicals in seven African countries suggest that use of chemical repellents may be one promising strategy for reducing damage. The DWRC team has initiated various critical phases of basic laboratory research on imported quelea. A new research unit of the DWRC was established in May 1977 at Khartoum, Sudan. Its primary objective is to protect small-grain crops such as wheat, rice, sorghum, and millet from quelea damage.

One promising chemical is methiocarb [4-(methylthio)-3,5-xylyl N-methylcarbamate], a short-lived, biodegradable, carbamate compound originally developed as a broad-spectrum insecticide. Methiocarb has now been shown to be a safe and effective repellent for many different bird species when sprayed on crops at rates as low as 1.0 lb per acre (Guarino, 1972). In preliminary investigations of the compound's effects on quelea, Schafer et al. (1973) determined that the acute LD_{50} was 4.2 mg/kg administered orally and 100 mg/kg administered dermally. Besser (DWRC, personal communication) found that caged quelea were repelled by 0.1% methiocarb on millet seed and believed that they could probably detect much lower concentrations.

RESEARCH FINDINGS

With this preliminary indication of the compound's effectiveness, a biologist of the Denver Wildlife Research Center, in cooperation with local personnel, conducted field experiments in 1974 on methods of reducing damage by quelea to ripening wheat near Nanyuki, Kenya, and to ripening rice near Rujewa, Tanzania. The experimental bird repellent "methiocarb" was effective in reducing quelea damage to both crops (De Grazio, 1974).

In both tests, small plots were sprayed with a formulation of 3 lb (a.i. 75% w.p.) methiocarb and 15 gal of water/acre. In the wheat test, a 0.25-acre plot was selected for treatment and a similar 0.25-acre plot as the control; both plots were located at the edge of large fields and both were bordered by brush and grass tracts. In the rice test, a 0.12-acre plot was treated and a similar 0.12-acre plot was left untreated as the control area.

Posttreatment damage surveys in wheat showed that damage was eight times higher on the control plot (493 wheat heads damaged per 1,000) than on the treated plot (60 per 1,000). In rice, damage was 10 times higher on the control (510 per 1,000) than on the treated plot (50 per 1,000). Population estimates in and around the wheat plots showed that two times more birds per observation were on the treated plot (1,278 birds) than on the control (612) before treatment, versus three times more birds on the control (629) than on the treated (182) after treatment. In rice, there were two times more birds per observation on the control plot (65) than on the treated (32) before treatment, versus five times more birds on the control (174) than on the treated (39) after treatment.

African investigators have reported that wheat is the small-grain crop most severely damaged by quelea and is followed sequentially by rice, finger millet, bulrush millet, and sorghum. The good results with wheat and rice indicate that methiocarb should be tested on these other crops and that lower concentrations may be effective in providing protection.

In laboratory tests at DWRC, methiocarb was highly repellent to caged quelea. Shumake et al. (1976) determined the R_{50} of methiocarb for male quelea to be 0.015% with 95% C.L. of 0.011-0.021%. Thus, quelea were about six times more sensitive than red-winged blackbirds (Agelaius phoeniceus) (R_{50} = 0.089%) and three times more sensitive than house sparrows (Passer domesticus) (R_{50} = 0.042%) to the repellent activity of methiocarb. These data indicate that methiocarb (and perhaps other repellents) should have good potential to alleviate agricultural crop damage caused by quelea in Africa.

These preliminary tests demonstrate that methiocarb may be an effective approach to the quelea problem, and further investigations are planned. In the United States, methiocarb has been shown to be a safe and effective repellent for many bird species when sprayed on crops at rates as low as 1.0 lb per acre (Guarino, 1972).

CONCLUSIONS

One cannot, of course, conclude from these small-scale, unreplicated field trials that methiocarb will solve the problem of quelea damage to ripening grain. The results do indicate, however, that this approach has promise. In both of these small-scale rice and wheat tests, methiocarb apparently reduced the expected level of bird damage considerably, even though methiocarb was sprayed on only one small plot in each field. Guarino (1972) has pointed out that experimental design can significantly affect the results of field tests with repellents and stressed that treatment of large areas is often more effective than treatment of small plots within fields. Therefore, we believe that protection from bird damage will be even greater than shown in our small-scale tests when entire fields are treated with methiocarb, possibly with even lower treatment levels. For these reasons, DWRC personnel, in cooperation with the Plant Protection Department, Ministry of Agriculture, Sudan, intend to pursue large-scale field investigations with methiocarb on small-grain crops in Africa.

If these tests are successful, methiocarb will have many advantages over methods now used to lessen quelea damage. Methiocarb is economical at the low application rates needed, is easily applied by the farmer, and is safe to consumers of the crop and to the many noninjurious bird species that may feed in the grain fields. In addition to being a bird repellent,

methiocarb is an effective broad-spectrum insecticide and will not contribute to long-term environmental contamination (Hermann and Kolbe, 1971).

Finally, if simply spraying a crop with bird repellents such as methiocarb will economically and safely protect it from bird damage, the wide-scale destruction of birds, with its attendant dangers to man, the habitat, and other wildlife, will become unnecessary.

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