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The simultaneous completion of the rainy season and nesting of granivorous birds between October and November in the Sudano-sahelian region of Senegal often results in very extensive bird damage to cereal crops. This occurs from both increased bird populations, due to the presence of juveniles as well as from their accompanying change in diet from insects to seeds. The damage is caused by several species of birds, most notable the Red-billed Dioch *(Quelea quelea)* and the Village and Black-headed Weavers *(Ploceus cuculiatus* and *Ploceus capitalis)* . The Buffalo Weaver *(Bubalornis albirostris)* and the Glossy Starling *Lamprotornis chalybaeus)* also are at times serious crop depredators.

Traditionally, farmers employ many different frightening techniques to chase or scare birds from their crops. The methods provide at best only temporary relief and require considerable time and energy. A possible solution to the bird problem involves the use of chemical repellents applied directly to the ripening grain. The purpose of the trial reported here was to evaluate methiocarb or Mesurol [4-(methylthio)-3,5 xylyl N - methylcarbamate] as a bird repellent on ripening sorghum. The study was undertaken as a part of the Regional UNDP/FAO Project "Research into the Control of Grain-eating Birds," aimed at the development and improvement of control techniques to prevent or reduce bird damage to cereal crops.

The effectiveness of methiocarb as a nonlethal bird repellent has been demonstrated on several types of crops, among them cherries (Guarino, et al., 1974), blueberries (Bollengier, et al., 1973), sorghum (Mott and Lewis, 1975) and rice (DeHaven, et al., 1971). Trials by DeGrazio and DeHaven (1974) on wheat and rice in eastern Africa also have shown promise. Likewise, the Quelea Project has obtained some success with it against *Passer luteus, Quelea quelea,* and *ploceus capitalis* when applied to both ripening millet and rice (Bruggers, 1975, 1977).

METHODS

Test site: The trial was conducted on sorghum variety CE 90 at an Institut Senegalais de Recherches Agronomiques (I.S.R.A.) field station at Darou, Senegal. The treated zone comprised four consecutive 550 m^2 bands (2220 m^2 total) adjacent to three other control bands (1650 m^2 total). Treated and control zones were separated by a 0.5 m path and three 15-cm red, plastic ribbons mounted on poles above the sorghum heads.

The test parcel was located between fields of millet and sorghum planted by I.S.R.A. personnel for replicate variety trials in a corridor between dense strands of *Combretum glutinosum* and *sclerocarya birrea* trees 10-12 m in height and about five m from the cereal plots (Fig. 1). Other vegetation in the immediate area included A*ndropogon gayanus* (bordering the parcel and the site of several *Euplectes orix* nests), *Borreria vertioillata, Eragrostis* sp., *Pennisetum* sp., *Striga sp.,* and *Cassia tora.* The surrounding region was a *sclerocarya* forest, in which farmers had planted sorghum and millet. Local cereal crops were maturing and being harvested at the onset of the trial.

Treatment: Mesurol WP (50%a.i.), to which was added 8.4 cc of Triton AE adhesive, was applied in water at a rate of 2.5 kilo a.i./ha to four bands (nos. 4-7) on 13 October 1975. This treatment was made prior to the onset of bird pressure (with the sorghum in the flowering stage). Two bands (nos. 5 and 7) were retreated on 24 October with the sorghum in the milk and soft dough stages. Application was with a Holder Motorized Atomizer using a spray rate of 0.63 1/min and a spray range of about three m. Wind velocity, measured with a Dwyer Wind Meter, averaged less than 2.5 km/h during both treatments.

Damage assessment and yield estimates: From the time of treatment and at intervals throughout the ripening period, 20-25 different, randomly selected heads per band were scored as either attacked or unattacked and the percent damage visually estimated. At harvest on 4 November, 100 such heads per band were collected, sun dried for three weeks, then individually threshed and weighed. Because of non-uniform feeding pressure, particularly within the control bands, an additional 200 heads per band were collected. One hundred were randomly picked from the front and back halves of all bands, were dried, then threshed and weighed in 100-head groups. Therefore, a total of 300 heads per band or 900 and 1200 heads per control and treated zone, respectively, were collected at harvest (Plate I-A, B, C). All threshing was with a Saatmeister Kurt Pelz (Model 7780776) automatic thresher.

RESULTS AND DISCUSSION

Weekly damage estimates: Treatment effects were evident by 17 October and highly pronounced by 23-30 October, when the sorghum was in the milk and soft dough stages (Table 1). Damage in the control zone increased substantially each week but remained low in the treated zone. Only band 4 in the treated zone, undoubtedly because of its proximity to the untreated zone, was noticeably damaged. In the other three treated bands, less than 4% of the heads were attacked, and only a few grains were eaten. This indicated a tasting and rejection of treated grain.

Yield measurements: The difference in the amount of damage between the two zones was pronounced. All yield measurements showed much less damage in the treated zone. At harvest only 11% of the treated heads had been attacked (*avg. 4% damage per head*), whereas 88% of the controlled heads were attacked (avg. 67% damage per head). Differences in all yield parameters from the treated zone were significantly ($P<0.05$ to $P<0.001$) greater than in the control zone (Fig. 2). The average weights per control and treated heads, respectively, were 15.8 g (range among bands of 8.4-27.2 g/head) and 49.4 g (range of 37.9-55.0 g/head) At harvest the number of seeds per head that was undamaged when marked prior to each treatment was nearly 100% greater in the treated (2064±532) than control (1118±769) zone.

Distinct yield gradients were evident among bands (increasing from the first control to the last three treated bands) and within control bands (from back to front). This gradient was, however, entirely related to the birds' feeding behavior, not to heterogeneity in the sorghum, since mean difference in head lengths and weights between each band and between the treatment and control zones as a whole were not different ($P>0.05$). The sorghum was taller in the treated zone, which, if anything, should have resulted in increased attack in this zone. Yet damage to this zone (particularly bands 5-7) was restricted to the last three rows.

Although the overall yield from those bands receiving two treatments was greater than those receiving one treatment, this difference resulted from more damage to band 4 than to bands 5, 6, and 7 prior to the second treatment. The average number of seeds per head at harvest for the five heads marked immediately prior to the second treatment was nearly identical: bands 5 and 7 = 2099 seeds and band 4 and 6 = 2077 seeds. Therefore, although the second treatment did not significantly ($P>0.05$) contribute to an increased yield, it probably reinforced the repellency. However, both the edge effect and the damage to band 4 clearly substantiate the findings of DeHaven, et al. (1971), demonstrating the desirability of having large, completely independent treated and control zones when conducting bird repellent trials.

Bird species and feeding intensity: Feeding pressure was from 13 bird species, but primarily *Ploceous cucullatus* and *capitalis* (Ploceid Weavers), *Lamprotornis chalybaeus* (Starlings), *vinago waalia* (Pigeons), and *Bubalornis albirostris* (Buffalo Weavers) (Table 2). During 64, 15-min. counts, three and one half times more birds were counted feeding in the control (2842) than in the treated (802) zone, with the greatest feeding pressure occurring during the late milk and soft dough stages (Fig. 3). The zones were equally susceptible, as birds entered them and the adjacent variety trial sites from both tree borders.

Ploceus cucullatus (flocks of 5-15 individuals) usually picked at the grains when perched on the stalks below the heads. Other species (as many as 250 *L. chalybaeus,* 50 *vinago waalia* and 25 B. *albirostris* at one time) always landed directly on the heads, somewhat flattening them in the process, and vigorously pulled out the grains. Glossy Starlings, in particular, moved among different heads, a behavior which in the later stages of maturation dislodged many grains and resulted in broken stalks when more than *one* bird simultaneously landed on a head (Plate I-D). These flattened, damaged heads may have been recognized as more palatable than the undamaged, treated heads, which indirectly would have contributed to the efficiency of the repellent.

Euplectes orix and *Ploceus* spp. appeared to be the species most affected by the treatment and *Poicephalus senegalus* (Parrots) the least. This observation is partially substantiated by checks made on the time spent feeding on the heads by several individuals of each species. Five different *p. cucullatus* individuals averaged 29 sec per head (range of 10-45 sec) in the treated zone, moving among three or four heads. The same individuals fed for 125 sec per head (range of 45-330 sec) in the control, usually on the same head. Conversely, three parrots which were timed landed and fed on both treated and control heads for as long as 30 minutes.

SUMMARY

Mesurol WP (5 kg of *50%* a.i.). was applied to 2220 m^2 of ripening sorghum planted in four consecutive bands of 550 m^2 each. This treated area was adjacent to but separated from a 1650 m^2 control zone composed of three comparable bands.

Mesurol excellently protected the sorghum from several species of granivorous birds, primarily Starlings, Ploceid Weavers, and Green Pigeons. Three and one-half times more birds were counted in the control as in the treated zone, a significant feeding pressure difference (P<0. 01), At harvest only 11% of the treated heads had been attacked (averaging 4% damage/head), whereas 88% of the control heads were attacked (averaging 67% damage/head).

Likewise, differences in all yield parameters from the treated zone were significantly (P< 0.05) greater. The average weights per control and treated heads were 15.8 g and 49.4 g, respectively. There was no difference in yield between those bands receiving one and two treatments (P>0.05).

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LITERATURE CITED

Bollengier, R.M., Guarino, J.L. and C.P. Stone. 1973. Aerially applied methiocarb spray for protecting wild lowbush blueberries from birds. Bird Control Seminar, Bowling Green, Ohio 6:216-220.

Bruggers, R.L. 1975 . Evaluation of methiocarb as a bird repellent on ripening millet. Int. Rep. No 232. Quelea Project Dakar, Senegal 5p.

Bruggers, R.L. 1977. Direct protection of maturing rice from birds at Richard-Toll, Senegal Int. Rep. No. 258. Quelea Project Dakar, Senegal, 14 pp.

DeGrazio, J.W. and R.W. DeHaven. 1974. Vertebrate Damage Control Research. Quelea Bird Problems in African Agriculture. Annual Report U.S.D.I. 28p.

DeHaven, R.W., Guarino, J.L., F.T. Crase, and E.W. Schafer, Jr. 1971. Methiocarb for repelling blackbirds from ripening rice. International Rice Commission Newsletter 20(4):26-30,

Guarino, J.L., W.F., Shake, and E.W. Schafer, Jr. 1974. Reducing bird damage to ripening cherries with methiocarb. J. Wildl. Manag. 38(2):338-342.

Mott, D.F. and L.E. Lewis. 1975. An evaluation of an aerial application of Methiocarb for protecting ripening grain sorghum from blackbirds at Sand Lake National Wildlife Refuge, South Dakota. Work Unit DF-102.3, No. 57, Denver Wildlife Research Center, 9p.

Sokal, R.R. and F.J. Rohlf. 1969. Biometry. W.H. Freeman and Co., 776p.

TABLE 1. Damage estimates during ripening to 20-25 randomly selected heads per band at Darou, Senegal.

Date	Percent heads attacked control	Percent heads attacked treated	Average percent damage to attacked heads control	Average percent damage to attacked heads treated
13 October	2	0	0	0
17 October	24	4	13.8	1.0
range			(1-50)	(1-2)
22 October	77	10	27.0	1.5
range			(1-100)	(1-5)
29 October	88	16	56.5	2.6
range			(5-100)	(1-10)
4 November	88*	11*	66.8	3.9
range			(1-100)	(1-15)

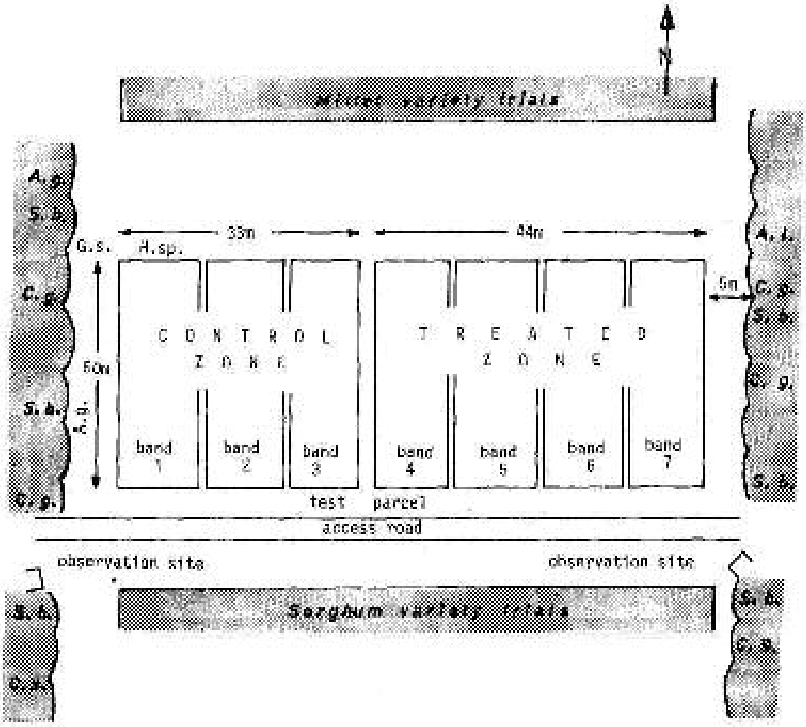
*Sample sizes were 675 and 900 heads, for control and treated zones, respectively.

TABLE 2. Bird species observed feeding in sorghum during a Methiocarb trial at Darou, Senegal during October and November 1975.

NAME Scientific	Common	Feeding Strategy Heads	Feeding Strategy Ground
Ploceus cucullatus	Village Weaver	x	
Ploceus capitalis	Black-headed Weaver	x	
*Ploceus vitellinus**	Vitelline Masked Weaver	x	
*Passer luteus**	Golden Sparrow	x	
*Passer griseus**	Grey-headed Sparrow		x
Euplectes orix	Red Bishop	x	
Bubalornis albirostris	Buffalo Weaver	x	
Lamprotornis chalybaeus	Glossy Starling	x	x
*Lonchura cucullata**	Bronze Mannikin	x	
Streptopelia senegalensis	Laughing Dove		x
*Turtur abyssinicus**	Black-billed Wood Dove		x
Poicephalus senegalus	Yellow-bellied Parrot	x	
Vinago waalia	Green Pigeon	x	x

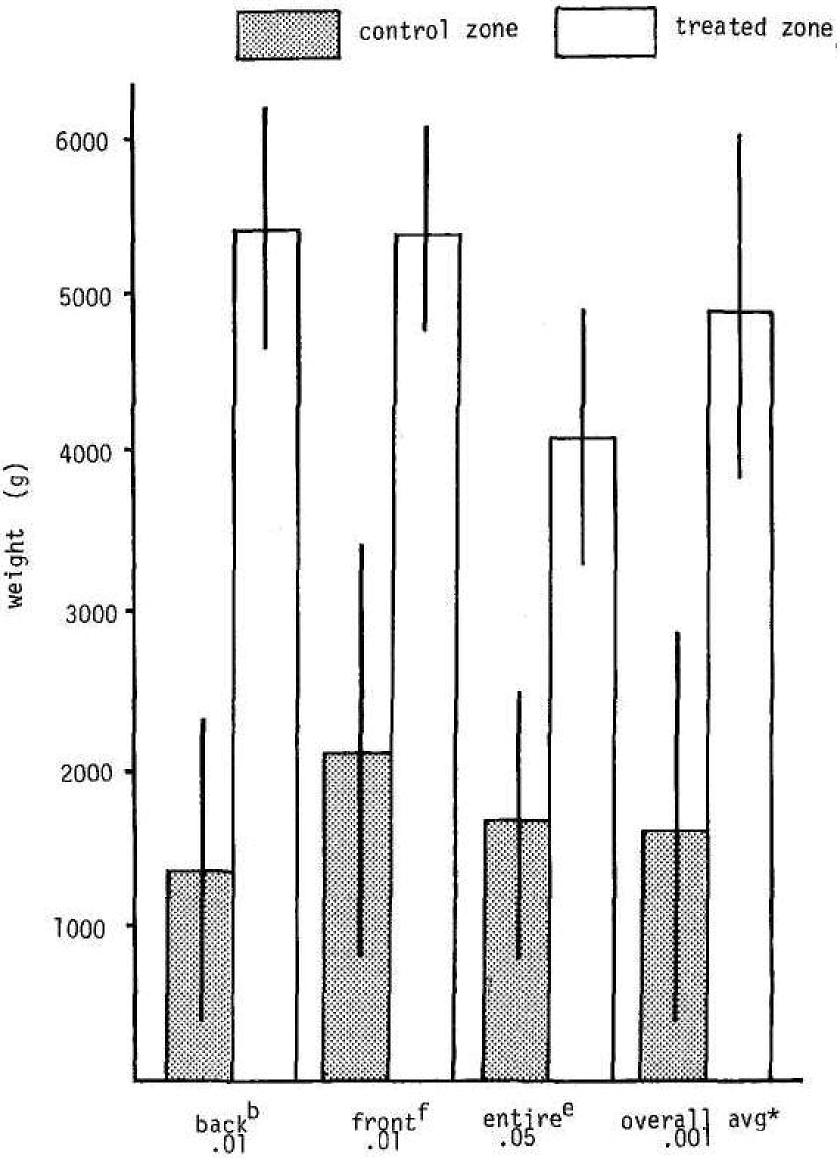
*only occasional visitors

Fig. 1: Methiocarb trial site at I.S.R.A. Field station, Darou, Senegal



key to bordering vegetation:
A.g. - Andropogon gayanus
A.l. - Anogeissus leiocarpus
S.b. - Sclerocarya birrea
C.g. - Combretum glutinosum
C.t. - Cassia tora
H.sp - Hibiscus sp.
G.s. - Guiera senegalensis

Fig. 2: Average yields (± ISD) per zone of 100 head samples collected in the back, front and throughout 3 control and 4 methiocarb-treated bands of sorghum at Darou, Senegal.



treated zone.

[e]100 heads, randomly collected throughout each band.

* overall average based on 900 heads/control and 1191 heads/treated zone.

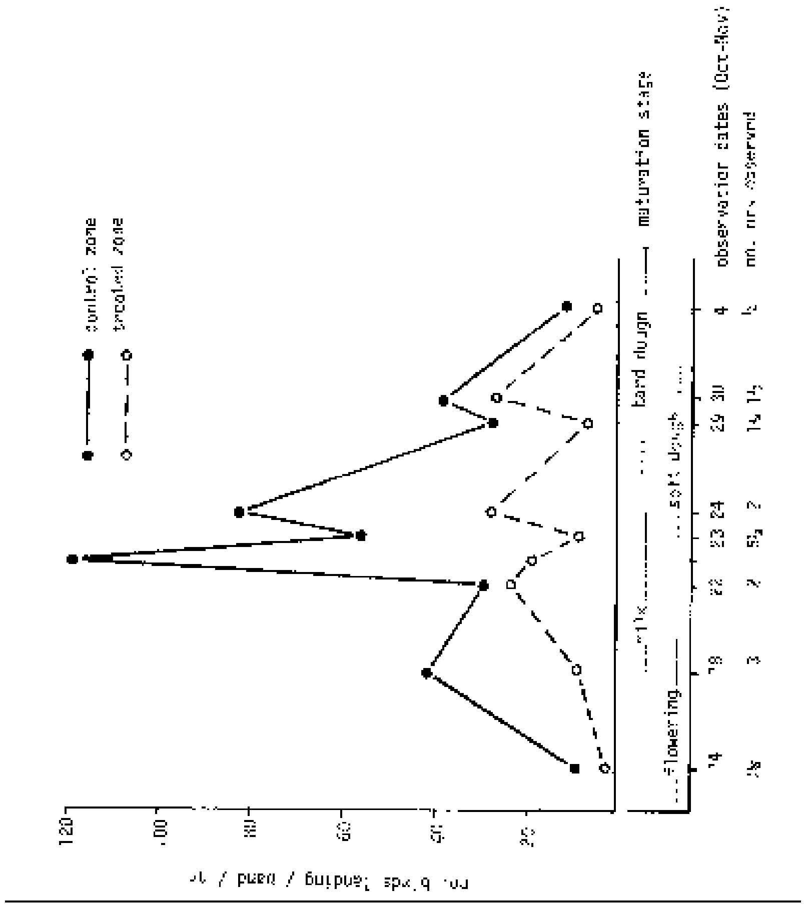
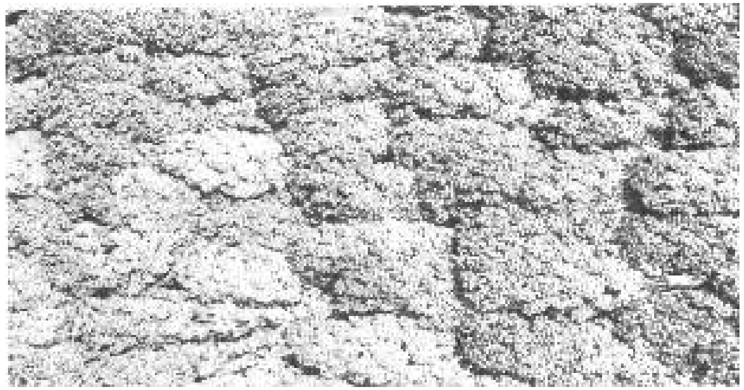
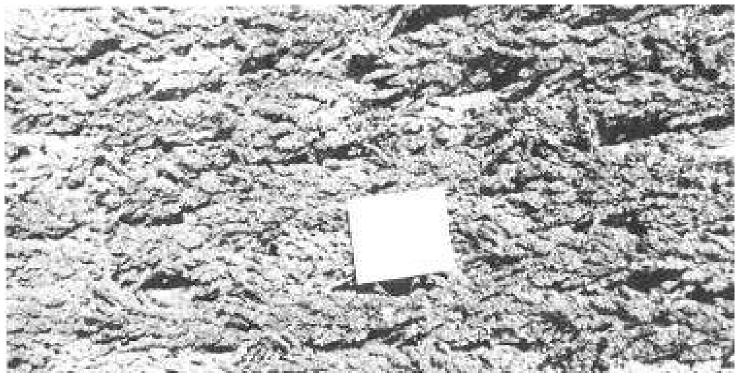


Fig. 3.: Average number of birds landing in each Methiocarb-treated and control band per hr at Darou, Senegal.



B. Part of 100-head sample collected from treated band no. 5.



C. Sorghum heads from control band no. I.

D. Glossy Starlings feeding in control zone.

BRUGGERS
Plate I.