TOXICITY OF CROTOXYPHOS INSECTICIDE
TO BRAHMAN CALVES AND BRAHMAN
AND CROSSBRED YEARLING STEERS

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ABSTRACT

CROTOXYPHOS (Ciodrin™) insecticide was applied to Brahman calves and Brahman and crossbred (Hereford-Angus) steers to determine its effect on blood cholinesterase. Brahman calves treated with 946 ml of 1% cROTOXYPHOS spray showed inhibition in whole blood and red cell cholinesterase (p <.01). Two out of 4 calves exhibited severe toxicosis and 1 developed skin lesions. Brahman calves treated with 946 ml of 0.5% cROTOXYPHOS spray or 3% CROTOXYPHOS dust showed cholinesterase inhibition (p <.01) but no observed toxicosis. Whole blood and red cell cholinesterase of Brahman and crossbred steers were inhibited (p <.01) when treated with 1.9 l of 0.5% cROTOXYPHOS spray per head at weekly intervals for 11 weeks. Brahman animals had a greater (p <.01) inhibition than crossbred steers. The 3% cROTOXYPHOS dust offered as free-choice in a self-applicating dust bag produced no cholinesterase inhibition in Brahman and crossbred steers; 2.7 kg of dust were depleted from the dust bag during the 11-week period.

CROTOXYPHOS (Ciodrin™) is commercially available for horn fly control, but application to Brahman cattle and calves of any breed under 6 months of age is restricted by label. Weidenbach and Younger (1962) showed that a 2% cROTOXYPHOS spray produced diarrhea and muscular weakness in 7 of 11 dairy calves for 10 to 16 days post-treatment. Palmer and Danz (1964) found that Brahman and Brahman-cross cattle developed toxicosis and blood cholinesterase depression to a 1% cROTOXYPHOS spray, or 20 mg/kg orally of chlorfenvinphos. Palmer (1965) later found that Brahman bulls 1 to 1 1/2 years old when treated with 0.25% dioxathion spray had a greater cholinesterase depression than did Brahman or Hereford heifers of equivalent age. Palmer (1971) determined that 13.2% famfur (30 ml/90.0 kg of 13.2% concentrate) produced more cholinesterase depression and toxicosis of Brahman cattle than in Hereford cattle.

Because of favorable research findings and the developing commercial use of self application dust bags for horn fly control in Florida, the present study was initiated to determine the relative safety of dusts as compared to spray applications of cROTOXYPHOS to Brahman and crossbred beef animals.

METHODS AND MATERIALS

The study was conducted at the Agricultural Research and Education Center, Belle Glade, April-September, 1968. Animal toxicosis was determined by clinical symptoms of organophosphate poisoning and by inhibition of

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whole blood and red cell cholinesterase activity. Clinical symptoms of organophosphate toxicosis used included dyspnea, constriction of pupils (myosis), diarrhea, profuse salivation, stiffness, inability to stand, and clonic convulsions.

Blood samples were collected in 10 ml heparinized tubes, with 15 gauge California bleeding needles used for jugular vein puncture. Red cell cholinesterase activity was determined by the method of Michel (1949). Whole blood cholinesterase activity was determined by modification of this method by substituting whole blood for red cells as reported by Younger and Radeleff (1964). Whole blood and red cell data were subjected to analysis of variance, and differences among treatment means were detected by Duncan’s multiple range test. Shell Chemical Company supplied crotuxyphos as Ciodrin™ emulsifiable concentrate (132 g/l) and 3% Ciodrin™ Livestock Dusting Powder.

**Brahman Calf Study**—Fifteen 4 month-old Brahman steers weighing an average of 122 kg were randomly assigned to one of 4 groups, and each group was confined during a 21-day test period to a separate sheltered pen with a concrete floor. The experimental groups were: (1) an untreated group, (2) a 3% crotuxyphos dust group, (3) a 0.5% crotuxyphos spray group, and (4) a 1% crotuxyphos spray group. The untreated group contained 3 calves; all other groups consisted of 4 calves. The 3% crotuxyphos dust was hand-applied at the rate of 87 g per head per day. The spray was applied to each calf individually by use of a small compressed-air hand sprayer. The calves were sprayed weekly with 946 ml per head.

**Brahman and Crossbred Steer Study**—Fifteen yearling Brahman steers and 15 yearling crossbred (Hereford-Angus) steers were assigned to 1 of 3 experimental groups: (1) an untreated group, (2) a spray group, or (3) a dust group. Each group contained 5 Brahman and 5 crossbred steers, and were grazed on separated St. Augustinegrass pastures. Steers in group 2 were sprayed as a group once weekly for 11 weeks with 0.5% crotuxyphos spray applied through a #0815 Tee Jet nozzle with an 86° spray angle. The yearling steers were sprayed with approximately 1.9 liters of 0.5% crotuxyphos per animal at a pressure of 14.06 kg/cm². The 3% crotuxyphos dust was provided free choice in a self-applicating dust bag.

**Results**

**Brahman Calf Study**—The first application of 1% crotuxyphos spray to 4 Brahman calves resulted in 1 animal developing mild toxicosis 15 min after treatment. Symptoms included increased salivation and myosis. By the sixth day this animal had severe hair loss on the tailhead, rump, thigh, and twist. Also this animal had burned scabby lesions on both sides of the neck which extended to the dewlap. Some hair loss was observed on the other 3 animals treated with 1% crotuxyphos spray.

The second application of 1% crotuxyphos spray resulted in a moderately acute toxicosis of the same calf that suffered mild toxicosis after the first spraying. The animal was unable to walk or stand 45 min after treatment. Symptoms included clonic convulsions, profuse salivation, general incoordination, dyspnea, myosis, and lachrymation. The animal was then given atropine sulfate, the recommended treatment for organophosphate poisoning, at the rate of 30 mg/45 kg body weight. Within 1 hr after injection, the calf had
sufficiently recovered to walk, but with much difficulty. Another calf in this
group developed mild toxicosis. Mild clonic convulsions were noted
approximately 1 hr after treatment. Four hours later, the symptoms had
disappeared.

The 2 calves that had previously developed toxicosis to 1% crotypsyhos
spray had an acute reaction 15 min after the third spraying. Severe muscle
twitching, incoordination, increased salivation, and the inability to stand were
observed 20 min after treatment. These 2 calves were treated with atropine
sulfate, but the incoordination of these animals persisted for 36 hr. The other
2 animals that were exposed to the 1% spray did not develop toxicosis or skin
irritation. The 3% crotypsyhos dust and the 0.5% crotypsyhos spray did not
produce toxicosis, dermal lesions, or hair loss.

![Graph](image)

Fig. 1. Whole blood cholinesterase activity of Brahman calves exposed to
crotypsyhos spray and dust treatments. Spray treatments were applied on
days 0, 7, and 14.
Crotuxyphos application inhibited whole blood cholinesterase in all treated animals (Fig. 1). Whole blood cholinesterase activity for the untreated animals was significantly (p < .01) higher than that of any of the treated groups. The whole blood cholinesterase activity of the 0.5% spray was significantly (p < .01) higher than the 1% spray group and the activity of the 3% dust group was significantly (p < .01) higher than that of either spray group.

Red cell cholinesterase activity was also inhibited in treated animals (Fig. 2). The treated groups were characterized by significant (p < .01) red cell cholinesterase inhibition but with high variation. The 1% spray produced the greatest (p < .01) red cell cholinesterase inhibition.

Fig. 2. Red cell cholinesterase activity of Brahman calves exposed to crotuxyphos spray and dust treatments. Spray treatments were applied on days 0, 7, and 14.
Fig. 3. Whole blood cholinesterase activity of Brahman and crossbred yearling steers exposed to crotoxyphos spray and dust treatments.

*Brahman and Crossbred Steer Study*—The first application of 0.5% crotoxyphos spray to yearling Brahman and crossbred steers produced mild toxicosis in 1 of the 5 Brahman steers. Symptoms were observed approximately 30 min after the spray application and included mild muscle twitching, increased salivation, and staggering. All symptoms disappeared 1 hr after onset. There were no other symptoms of organophosphate intoxication
Fig. 4. Red cell cholinesterase activity of Brahman and crossbred yearling steers exposed to crotoxyphos spray and dust treatments.

observed in this animal after subsequent treatments with 0.5% crotoxyphos spray. The 3% dust animals were not visibly affected during the study; 2.7 kg of dust were depleted from the dust bag used by this group during the 11-week study.

The 0.5% spray caused a significant (p < .01) inhibition of whole blood or red cell cholinesterase when compared to the untreated animals; there was no significant (p > .05) difference between the dust and the untreated animals.
Further analysis revealed that Brahman animals treated with a 0.5% crotoxyphos spray had significantly ($p < .01$) lower whole blood and red cell cholinesterase activity than cross bred animals on the same treatment (Fig. 5—whole blood) confirming differences in susceptibility to certain organophosphates as reported by Palmer and Danz (1964), Palmer (1965), and Palmer (1971).

**Fig. 5.** Whole blood cholinesterase activity of Brahman yearling steers and crossbred yearling steers treated with 0.5% crotoxyphos spray.
LITERATURE CITED


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