THE EFFECT OF INSECTICIDE IMPREGNATED EAR TAGS ON CATTLE WEIGHT GAIN AND FLY POPULATION

by

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LITERATURE REVIEW

Horn Flies on Pastured Cattle

The horn fly, Heamatobia irritans (L.), is a serious pest on pastured cattle. The blood sucking habit of horn flies causes definite reductions in cattle performance (Cheng, 1958; Cutkomp and Harvey, 1958). Losses in animal performance are over $200 million a year. Granett and Hansens (1956) noted increased milk production in dairy cows for a one to two day period after spraying them with methoxychlor or methoxychlor plus butoxy polypropylene glycol. Horn fly numbers were lowered, but not completely eliminated, for five to seven weeks.

Insecticidal sprays and dips were the first successful methods introduced to combat horn flies (Laake, 1946). Cows and calves were sprayed or dipped in solutions of 0.2 or 0.1% dichlorodiphenyltrichloroethane (DDT). The cattle were treated either three or four times during the test period from June to October, while grazing native pasture in Kansas. All cattle in some herds and half of the cattle in other herds were treated. Treatment of an entire herd resulted in longer fly protection than the half herd treatments and no difference was observed between dipping and spraying.

Fly control lasted from 12 to 36 days per treatment. Each successive treatment provided longer protection. Weaning weights of calves in the treated herds were 42.2 and 70.0 lbs heavier than calves from non-treated herds. Treated cows gained 30 to 51 lbs more than untreated cows.

Cutkomp and Harvey (1958) used an automatic treadle sprayer on yearling steers and heifers to control horn flies. Cattle were sprayed at least once a day with pyrethrins plus piperonyl butoxide or N-octyl bicycloheptene dicarboximide in this three year study. For the first two years the treated cattle gained significantly more than untreated cattle. Treated cattle had daily gains of 0.73 and 1.30 lbs while daily gains for untreated cattle were 0.48 and 0.63 for years one and two of this study. In the final year the untreated cattle gained 0.72 lb and the treated cattle only 0.36 lb/day, which was not significant ($P>.05$). The authors attributed the third year difference to abnormally high forage availability during the entire summer. Horn fly control was 92 to 99% for each of the three years. Daily use of a sprayer was also studied by Cheng (1958) using six different chemicals over an eight week period. Horn fly control averaged 88.0% for the eight week period (range of 84.4 to 95.3%) with no significant differences between the six chemicals. Treated yearling heifers gained 27.2 lbs more ($P<.01$) than similar untreated heifers, and treated cows gained 44.8 lbs more ($P<.05$) than untreated cows.

Face Flies on Pastured Cattle

The face fly, Musca autumnalis De Geer, is a more recent pest in this country, entering in the 1950's. Steve and Killy (1965) indicated that the face fly was capable of transmitting Moraxella bovis, a bacterium demonstrated to cause pinkeye (infectious bovine conjunctivitis). This bacterium, in its hemolytic form, could remain viable for three to four days on the face flies wings, legs and mouth parts. Cheng (1967) noted that cases of pinkeye increased in pastures where cows were more heavily infested with face flies. He noted face fly populations of 6-10, 11-15, 16-20 and 21-25 flies per cow with the incidence of pinkeye associated with these numbers being 14.5, 16.7, 26.0 and 28.0% respectively. Berkbile et al. (1981) indicated that face flies contaminated with M. bovis were positively related to active infection in cattle containing pinkeye but not significantly proportional to total fly populations sampled. Laboratory-reared face flies contaminated with M. bovis were capable of transmitting the pathogen to caged cattle (Brown and Adkins, 1972).

The face fly has been linked as a vector for other diseases. Infectious bovine rhinotracheitis (IBR) has been linked to face flies (Pickens and Miller, 1980) as have two species of eye worms (Thelazia rhodesi and T. californiensis). Parafilaria bovicola, a nematode parasite of cattle, has been reported in Asia, Europe and Africa (Anonymous, 1981).

Swedish research indicates the face fly is capable of transmitting this parasite, which causes hemorrhagic bovine filariasis, or "green muscle disease." The adult nematodes invade sub-cutaneous tissues of the neck, whithers and dorsal body regions and cause lessions that can increase meat trim loss and lower carcass value.

Irritation and annoyance from face fly feeding also disrupts grazing patterns and reduces grazing time (Schmidtmann et al., 1981). Ten to eleven face flies per heifer reduced grazing time by 20 to 25 minutes a day. Higher fly numbers reduced grazing time by up to 47 minutes a day. However, no differences in rate of gain were noted due to the reduced grazing times. Broce (unpublished) discovered that the mouth parts of the face fly contain sharp teeth that are capable of damaging the conjunctiva of the eye, which could increase chances for infection and pinkeye damage.

Insecticidal Sprays and Dust Bags

Weight gain of yearling cattle was studied by Haufe and Thompson (1964), treated with a 0.5% wettable powder suspension of coumaphos at three week intervals. DDT was used after week nine instead of coumaphos. For the first nine weeks the untreated cattle gained 30.2 lbs more than untreated cattle. The difference in gain was significant ($P<.01$) during the second and third treatment periods. During the fourth three week period the DDT treated cattle gained significantly more

(P<.01) than the untreated cattle (45.0 vs 32.4 lbs). Coumaphos toxicity was given as the reason for the weight loss during the first nine weeks of the experiment. No face or horn fly counts were taken, and no difference in animals needing treatment for conjunctivitis was noted. Roberts and Pund (1974) sprayed yearling steers with solutions of 0.5% carbanyl and 0.1% pyrethrins at weekly intervals to control horn and horse flies. During the first year of this experiment, horn fly control was 100% for the 16 week test period. Results from the second year showed 98% control of horn flies for 20 weeks. Horn flies on control steers averaged 137 per head for the first year and 357 for the second year. The treated herds had increased daily gains of 0.20 lb for the first year and 0.23 lb for the second year (P<.05).

Permethrin, a synthetic pyrethroid, has been used as a spray to control flies. Two hundred and fifty ml. of 0.1% permethrin applied to the backs of all cattle in a herd achieved adequate horn fly control for 24 days (Baile and Morgan, 1980). Non-biting flies, including face flies were satisfactorily controlled for seven days. Animal disturbance due to flies was apparent, particularly with horn flies. Harvey and Brethour (1979) used concentrations of 0.1, 0.25, 0.5, 1.0 and 2.0% of permethrin and sprayed one bull, cow or steer per herd. Animals were sprayed every two weeks with at least 250 ml of solution applied to each treated animal. One to two days after treatment all cattle were essentially

free of horn flies with substantial reductions (80-90%) maintained for one week. The 0.1% treatment lost all effectiveness after two weeks, while the other concentrations maintained slight control for up to 22 days. Though no counts were made, face flies did not appear to be controlled by the spray. Physical contacts among animals may spread the insecticide and its effects to untreated animals in the herd, which allows partial treatment of a herd to provide control for the entire herd (Beadles et al., 1977). A high amount of movement of flies to different animals in a herd can possibly explain why partial treatment of a herd can control flies on an entire herd (Schmidt and Kunz, 1980).

Campbell and Raun (1971) used fixed-wing aircraft to make ultra-low volume (ULV) applications of fenthion, trichlorfon, malathion and naled to cattle in open pastures. Though initially there was a 90% reduction in horn flies, five aerial applications of naled within 62 days was not enough to keep horn fly numbers below 50 per animal.

Dust bags containing coumaphos produced a significant ($P<.05$) reduction in horn fly numbers, with 11.9 horn flies per head on treated cattle and 200.1 flies per head on control cattle (Janes et al., 1968). No difference in control was noted between 1.0% coumaphos and 5.0% coumaphos treatment. In a separate treatment, cattle consumed a mineral containing 50% coumaphos at the rate of three lbs coumaphos mix to 100 lbs mineral. Average horn fly populations of 59.7 per head

for the six month test period were recorded in the treated area. Horn fly counts in adjacent pastures were lower than other control pastures farther away, which was presumed to be caused by flies migrating into the treatment pasture.

Campbell (1976) used dust bags with 3% stirofos, 1% coumaphos and 5% phosmet for three consecutive 30 day periods, with methoxychlor used for the final 60 days of a five month test. Dust bag usage was forced by placing the bags near gates to water tanks. Horn fly populations averaged 468.7 per cow side for the control herd and 14.9 per cow side for the dust bag treated herd. Weaning weights for treated and untreated calves were 387 and 347 lbs respectively ($P<.05$). Harvey and Brethour (1979) forced cattle to use dust bags containing 1% coumaphos for a six year period. Placement of dust bags near salt boxes allowed the cattle to be treated at 36 hour intervals. Horn fly control during grazing periods (May-Aug.) averaged 87% and during late grazing periods (Aug.-Oct.) averaged 84%. Average horn fly numbers were 30 and 66 for early and late treatment herds and 238 and 405 for early and late control pastures. Treated steers averaged significant ($P<.05$) more gain over the six year period than untreated steers during both early and late grazing periods (5 kg more per head early and 3 kg more per head late). Face flies were not controlled by the dust bags.

The insecticide ciodrin (impregnated in wax) was hand applied to cattle to provide long term horn fly control

(Harvey and Ely, 1969). Fifty grams of the wax containing 23% ciodrin was used per head. Horn fly control 13 days after the treatment ranged from 63 to 95% with April treatments offering more control than June or July treatments. In all cases, the wax treatment provided more control than coidrin that was sprayed on the cattle in the same quantities. The spray did not reduce horn fly numbers. Treating 23 to 33% of the animals in the herd with the wax gave 100% control one day after treatment and 82 to 94% control when only 12 to 23% of the herd was treated (Harvey and Ely, 1970). Seven days after treating 6 to 33% of the herd horn fly control was 74 to 94% with no significant differences between percentages of the herd treated. Treating 2% of the herd with the wax did not offer any apparent horn fly control.

Dichlorvos or Stirofos Impregnated Ear Tags

Insecticide impregnated ear tags were first reported as a method of horn fly control by Harvey and Brethour (1970). Resin strips containing 20% dichlorvos were attached to ear tags (20 g strips) and neck chains (50 and 108 g strips). Most cattle were free of horn flies the day after attachment of the strips, with populations held under 50 flies per head for 30, 21 and 5 days for the ear tag, 50 g neck chain and 108 g neck chain respectively. Beadles et al. (1979) used ear tags, leg bands and tail tags containing 20% dichlorvos strips to control flies. The strips were attached to the

ear tags of eight cows, placed on the lower rear legs of eight more cows, and clamped midway in the switch of the tail of eight cows. Control of horn flies averaged 92, 96 and 93% for the ear tags, leg bands and tail tags, respectively, for the seven week test period. Control cattle averaged approximately 500 horn flies per head.

Ahrens (1977) used an ear tag impregnated with 15% stirofos to control horn flies. Pretreatment horn fly counts were in excess of 1000 flies per animal. Horn fly numbers were reduced by 95% within two hours after tagging with one tag per ear. Counts of 1.5 flies per animal were observed six weeks post-treatment and 3.5 flies per animal 10 weeks post-treatment. Post-treatment horn flies averaged 60 per animal at 14 weeks and both treated and untreated animals averaged 500+ horn flies per head 16 weeks post-treatment. Stirofos tags were compared to conventional control methods (dust bags and spraying) by Shrode et al. No differences were observed between the stirofos tags and the conventional control methods, but both were significantly lower in horn fly counts than untreated cattle. Six cases of pinkeye were reported in the treated herds and 42 cases observed in the control herd. Sheppard (1980) used stirofos impregnated tags at different rates for horn fly control. One tag per head, two tags per head and two tags on 8 of 23 cattle were used as treatments. One tag per head gave good control (under 50 flies per side) for seven weeks while two tags per head gave

good control for 14 weeks. Two tags on 1/3 of the cows gave good control for 12 weeks.

Fenvalerate or Permethrin Impregnated Ear Tags

Two pyrethroids, fenvalerate and permethrin, impregnated in ear tags, are now available for the control of horn and face flies. Complete horn fly control (100%) for 20 weeks was reported by Ahrens and Cocke (1979) when 90% of an 80 head herd were tagged with one fenvalerate tag per ear. Fly numbers were noticeably reduced two hours after tagging, and cows were completely free of horn flies the following day. Horn fly numbers on untreated herds ranged from 500 to over 1500 per animal. Harvey and Brethour (1980) reported that tagging all cows in both ears or all steers in one or both ears provided complete horn fly control for their 20 week test with fenvalerate tags. When 46% of the cows in a herd were tagged in both ears, horn flies were eliminated for at least 10 weeks and their numbers remained low for an additional six weeks. Tagging both ears of 17% of the cows in a herd gave complete horn fly control for a six week test period. Double tagging 8% of the cows in a herd gave control for 10 to 12 weeks. As the percentage of cows tagged in a herd decreased the time required to achieve complete fly control increased. Face flies were observed on tagged animals, but face fly populations were too low to evaluate the tag's effectiveness against them. Herds with all steers tagged

(one or two tags) gained 8.8 kg more than similar untagged steers ($P<.05$). Kunz and Sims (1980) used two fenvalerate tags per head on a group of yearling steers and observed them to be essentially free of horn flies. Untagged steers had 500 to 700 flies per head. During the 120 day trials, tagged steers gained 38 lbs more than untagged steers.

Moore and Clark (1981) used different numbers of fenvalerate tags to control both face and horn flies. One tag per animal, two tags per animal and two tags on half of the animals all gave between 99.4 and 100% control of horn flies. Face fly control ranged from 60.2 to 68.6% for the 120 day test. Stirofos tags used the same year provided an 85% reduction in horn flies and a 42.8% reduction in face flies when used at two tags per head for 120 days. Two stirofos tags on half of the animals gave a 39.8% horn fly reduction and a 32.9% face fly reduction for the same period of time. One stirofos tag per animal did not control horn flies for the entire test even though face flies were reduced by 37.3%. When comparing fenvalerate tags to other methods of fly control, there was no difference between fenvalerate tags and ciovap spray (two ounces per animal every three to five days), or dust bags (3% ciodrin) for horn fly control. The tags did provide more face fly control than the dust bags (64.8% vs 37.5%) but were less effective than the spray (81%). Knapp and Herald (1981) used one fenvalerate tag per head to control both face and horn flies. Horn fly control for the 18

week test ranged from 76.1 to 100%, with the average being 90.1%. Face fly control ranged from 76.5 to 97.6% and averaged 85.4%.

Ear tags impregnated with 5 or 10% permethrin for controlling face and horn flies were used at one tag per animal by Williams et al. (1981). A non-tagged control group and coumaphos dust bag treatment were used for comparison. The 10% tags averaged 95% horn fly control for the 16 week test. The 5% tags and dust bag gave a 77 and 93% reduction in horn flies, respectively. Face fly control averaged 49% for eight weeks with the 10% tags. The dust bag yielded a 34% reduction in face fly numbers. No face fly control was achieved with the 5% tags. Williams and Westby (1980) used 5 and 10% permethrin and 1.5% decamethrin ear tags to reduce face and horn fly numbers on mature cows. One tag per animal was used for each of the three different tags. Average horn fly control for the 13 weeks was 95, 96 and 98% for the 5% permethrin, 10% permethrin and 1.5% decamethrin tags, respectively. The best face fly control was given by the decamethrin tags (47%). The 10% permethrin tags reduced face flies 32% while the 5% permethrin tags reduced face flies by 15%. Ten percent permethrin tags used by Knapp and Herald (1980) in each ear of cows and heifers gave an average face fly reduction of 74% with a range of 56 to 85%, and horn flies were essentially eliminated during a 14 week test.

Williams (1981) used permethrin tags at two rates (one per head and two per head) along with fenvalerate tags at two per head, stirofos tags at two per head and coumaphos dust bags. Face fly control with the permethrin tags averaged 64% for seven weeks and 73% for three weeks with two and one tags per head, respectively. No face fly control was achieved with the coumaphos dust bag treatment. All treatments provided excellent horn fly control.

Heel Fly, Louse and Tick Control

In addition to controlling face and horn flies, other cattle pests can be controlled with some of these insecticidal treatments. Cattle confined in a room with dichlorvos strips had varied degrees of louse control (Harvey and Ely, 1968). Cattle were housed in a 10 x 15 x 8 ft shed containing two seven ounce strips of 20% dichlorvos. A two hour confinement in the shed killed 40% of the lice, three hour confinement killed all lice except those under the halter, and a twelve hour exposure eliminated all lice.

Miller et al. used dichlorvos leg bands and ear tags, fenvalerate ear tags and crufomate pour-on to control heel flies and grubs. The ear tags were used at one tag per ear and one band on each hind leg. The pour-on gave the best control, but all treatments were beneficial, ranging from 72 to 100%. No significant differences ($P<.05$) were observed.

Gulf coast ear ticks and southern cattle ticks were controlled by both dichlorvos and stirofox impregnated ear tags (Gladney, 1976; Ahrens et al., 1977; Davey et al., 1980). The reduction in ticks also eliminated screwworm infestation in the ears. Control of 79 to 93% for southern cattle ticks was recorded for 3% decamethrin and 8% fenvalerate tags. Ahrens and Cocke (1978) obtained 85% control of Gulf coast ticks with either stirofos, fenvalerate, chlorpyrifos or ronnel tags during an 11 week test.

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THE EFFECT OF INSECTICIDE IMPREGNATED EAR TAGS ON CATTLE WEIGHT GAIN AND FLY POPULATION[1]

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Summary

Four trials using ear tags impregnated with insecticide were used to control horn flies, Heamatobia irritans, and face flies, Musca autumnalis De Geer, on pastured cattle. In trial 1 ear tags impregnated with 8% fenvalerate[5] or 10% permethrin[6] essentially eliminated horn flies (P<.01), and reduced face fly populations, when the tags were used over a large geographical area. Average daily gain for calves when both cows and calves were double tagged was 0.19 kg more (P<.01) than calves from an untreated herd. Double

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tagged yearling heifers gained 0.05 kg more ($P<.05$) daily than untreated heifers. In trial 2 fenvalerate impregnated tags significantly ($P<.01$) reduced horn fly numbers compared to oxytetracycline fed or non-tagged control cattle. Face flies were not affected by tagging or feeding oxytetracycline. Adjusted weaning weights were not significantly different ($P<.17$) between the three treatments (202.6, 199.8 and 197.6 kg for the tagged, oxytetracycline fed and control cattle, respectively). Trial 3 compared fenvalerate tags at two different levels and chlortetracycline in a mineral mix as treatments. The fenvalerate tags used at two tags per calf reduced horn fly numbers significantly ($P<.01$) over the chlortetracycline fed cattle. One fenvalerate tag on every other cow reduced horn fly numbers from the chlortetracycline fed cattle for the study period. No significant difference ($P>.15$) in face fly populations was observed bwtween the three treatments for the first four observation periods. Adjusted weaning weights for calves with two fenvalerate tags was significantly higher ($P<.05$) than the other two treatments (170.8, 160.3 and 157.6 kg for two tags per calf, one tag on every other cow and chlortetracycline, respectively). In trial 4, one fenvalerate tag per cow eliminated horn flies ($P<.01$) over control cattle. Ear tag tape devices and a pour-on, both containing permethrin, also offered significant ($P<.05$) horn fly control for most of the study. Face fly populations were not significantly different between

treatments.

(Key Words: Horn Flies, Face Flies, Fenvalerate, Permethrin)

Introduction

The use of ear tags impregnated with insecticides has been proven to be effective in controlling horn flies, Heamatobia irritans (L.), on pastured cattle (Harvey and Brethour, 1970; Ahrens, 1977; Ahrens and Cocke, 1979). Season long horn fly control using 8% fenvalerate or 10% permethrin tags at rates of one and two tags per head has been observed by Harvey and Brethour (1980) and Williams (1981). Horn fly control using tags on half of the animals in a herd has also been reported (Moore and Cmarik, 1981). Increases in weight gain for yearling steers resulting from the control of horn flies has been reported (Harvey and Brethour, 1980). The tags have been effective in controlling horn flies because the horn flies spend a majority of their time on the cattle which gives them more exposure to the insecticide. Face fly (Musca autumnalis De Geer) control with the various impregnated tags has been less successful than control of horn flies (Knapp and Herald, 1981; Moore and Cmarik; Williams and Westby, 1980). This is attributed to the face fly spending a lesser amount of its time on the animal, resulting in less exposure to the insecticide.

Four different trials were conducted to determine if insecticide impregnated ear tags could effectively control horn and face flies. An additional objective was to evaluate

the ability of the tags to effectively control horn and face flies over a large geographical area. A final objective was to determine if the control of horn and face flies would result in additional cattle weight gain.

Experimental Procedure

Trial 1. Two types of tags were used in this trial. One type was a polyvinyl chloride (PVC) tag weighing 10 g and containing 8% fenvalerate. This tag was of a two piece design (tag and button) and was applied with the ALLFLEX® tagging system. The second type of tag was a PVC tag weighing 9.5 g and containing 10% permethrin. This tag was also of a two piece design (tag and button) and was applied with the Y-TEX® tagging system.

This trial also investigated the use of the two types of tags over a large geographical area. A 73.4 square kilometer area (6.5 x 11.3 km) was used in the Flint Hills range area of southeastern Kansas during the summer of 1981. Cattle in the treatment block were divided into 31 herds totaling 1092 cows. Each cow was fitted with two impregnated tags (one in each ear). All the cows in the same pasture always had the same type of tag. Of the calves in the treatment area, 695 were given two tags per head and the remaining 279 were left untagged. All 247 yearling cattle in the 73.4 square kilometer area received two tags per head, except one pasture where 60 head were not tagged because the owner would not agree to cooperate.

Selected herds of cattle were randomly divided into treatment groups to determine weight gain response resulting from fly control. Herd 1 consisted of 47 cross-bred cow-calf pairs with each cow and calf treated with two fenvalerate (8%) tags per head. Herd 2 was composed of 21 cow-calf mates to herd 1 and served as untreated controls. All untreated herds were located outside of the block area. Herd 3 was 26 long yearling Simmental heifers that received two fenvalerate tags per head. Herd 4, which consisted of 18 mates to herd 3, served as untreated controls. All calves and yearlings were weighed when tagged and at the conclusion of the trial. The trial ran 161 days for herds 1 and 2 and 133 days for herds 3 and 4. Forage type and availability and stocking rate were similar for both treated and control pasture groups.

Four herds of Hereford and Simmental cattle were used to evaluate the effect of tagging the calves when the cows were already double tagged. In herd 5, fenvalerate tags were used and herd 7 received permethrin tags, with both cows and calves using two tags per head. Both herds had 24 cow-calf pairs. Herds 6 and 8 had 15 and 16 cow-calf pairs respectively. Each cow received two tags, but the calves were left untagged. Herd 6 used fenvalerate tags while herd 8 used permethrin tags. The trial ran 164 days for herds 5 and 6 and 122 days for herds 7 and 8.

To compare both horn and face fly populations, over 1000 cattle in pastures outside of the treatment block were monitored during the summer. Locations varied from adjacent to treatment pastures to over seven kilometers away from the treatment area. Fly counts were made at two week intervals from June 12 and continuing until October 9. The time of day that the pastures were monitored varied for each pasture. No pretreatment fly counts were made because of the amount of time required to tag all of the cattle in the area. Tagging started April 28 and was completed June 10. In addition to fly counts, one or two day old cow pats were collected from both treatment and control pastures to study fly migration.

Trial 2. Two piece PVC ear tags weighing 10 g and impregnated with either 5 or 8% fenvalerate were used. The trial was conducted in north-central Kansas (Washington County) during the summer of 1981. Cross-bred cattle of predominantly Hereford, Charolais, Angus, Gelbvieh and Simmental breeding were used since no prior studies have indicated any difference in attraction of either face or horn flies to be associated with breed or animal color.

Herd 1 consisted of 39 cow-calf pairs, where each cow received two 8% fenvalerate tags, but the calves remained untagged. Herd 2 was made up of 32 cow-calf pairs where each cow and calf received one 8% fenvalerate tag. Herd 3 consisted of 19 cow-calf pairs with each calf given two 8% fenvalerate tags and the cows left untreated. Herd 4

consisted of 16 cow-calf pairs where only the calf was given one 8% fenvalerate tag. Herd 5 had 40 cow-calf pairs, with each cow and calf receiving two 5% fenvalerate tags. The 63 cow-calf pairs in herd 6 consumed a mineral mix containing oxytetracycline and were not tagged. The mix contained 2.27 kg of oxytetracycline pre-mix (110 g per kg) per 45.5 kg of mineral prior to July 1 and was increased to 4.55 kg oxytetracycline pre-mix for each 45.5 kg of mineral after July 1. Herds 7, 8 and 9 served as untreated control herds with 22, 13 and 15 cow-calf pairs, respectively. Most of the pastures were located within a nine kilometer radius and were similar in type and quantity of available forage. The trial ran for 126 days.

The cattle were tagged on May 15 and fly counts taken at two to three week intervals starting June 19 and continuing through September 17. At the end of the trial, adjusted weaning weights were calculated for all of the calves. Bioassays were done with manure from control pastures and the pasture where oxytetracycline was fed to determine if the antibiotic inhibited fly development in the manure.

Trial 3. The same type of 8% fenvalerate tags previously described were used in this trial which was conducted in north-central Kansas (Cloud County) during the summer of 1981. Three Hereford herds were used in this study. Herd 1 consisted of 34 cow-calf pairs with two tags given to each calf and no tags on the cows. Herd 2 had 32 cow-calf pairs with

one impregnated ear tag attached to half of the cows and none on the calves. Herd 2 was further divided into three pasture replicates. The 32 cow-calf pairs in herd 3 consumed a mineral mix containing chlortetracycline at a concentration of 4.55 kg chlortetracycline pre-mix (50% chlortetracycline and 50% soybean meal) mixed with 45.5 kg of mineral. The trial ran for 164 days.

Tagging dates, fly counts and weighing procedures were the same as for trial 2. Manure from the antibiotic pasture was collected for bio-assays to check the effect the chlortetracycline had on fly larvae development.

Trial 4. Four herds of Hereford and Hereford-Simmental cross cattle were used in this study, which was conducted at the range research unit of Kansas State University located near Manhattan and used 8% fenvalerate tags. Herd 1 consisted of 57 cows and 38 calves with each cow given one 8% fenvalerate tag but the calves not treated. Herd 2 had 38 cows and 21 calves. Each cow received 113.5 to 141.9 ml of an experimental 1% permethrin pour-on.[7] The calves were not treated. Herd 3 consisted of 55 cows and 38 calves, with each cow receiving an experimental ear tag tape device which contained 0.90 g of permethrin in a breakable ampoule.[7] This device was installed around an existing ear tag in each cow. A group of 15 bred yearling heifers was left untreated and served as controls.

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[7]ICI Americas, Inc., Goldsboro, N.C. 27530.

Trial 4 began on May 28, with fly counts taken every two or three weeks. On August 18, new ear tag tape devices were placed on the cows in herd 3 because of losses of the original devices. Cows in herd 2 were also given another 113.5 to 141.9 ml treatment of the pour-on insecticide. Adjusted weaning weights were calculated for comparison purposes on the calves in herds 1, 2 and 3.

In all four trials horn fly and face fly populations were estimated by visual counts (with binoculars if needed) on 10 to 15 randomly selected animals in each herd. Fly counts were made at various times during the day, with no fly number variation observed during the day possibly due to lower than normal temperatures. Horn fly counts were estimates of the number of flies on the back, side and belly. Face fly counts included flies resting on or near the animals' eyes only. Mean fly counts were analyzed by Student's t distribution and one way analysis of variance at the 5% level of significance. Due to the abnormally distributed populations between treatments, the fly count data were transformed by means of a log transformation. Animal weight response was analyzed by a one way analysis of variance test, with means separated by least squares procedures.

Results and Discussion

Trial 1. The amount of face fly and horn fly control provided by the tags is presented in table 1. Horn fly numbers were reduced significantly ($P<.05$) at all observation

times during the test. Most treatment herds were free of horn flies the entire 16 week observation period. Though the face fly populations in the control herds were too low for an optimum evaluation of the tags' effectiveness, a significant reduction ($P<.05$) in face fly numbers was recorded for June, July and August. No difference was found in September or October. Emergence of flies from cow pats collected from tagged herds inside the treatment block area revealed that horn flies were migrating into the treatment herds from pastures with untagged cattle. Since no horn flies were observed on cattle in the treatment pastures, flies that were migrating into the treatment area were being killed by the insecticidal tags. The insecticidal effect of the ear tags was not observed in any untreated control pastures bordering the treatment area.

The control of flies resulted in both calves and yearling heifers gaining more weight. Daily gain for calves where both the cow and calf received two 8% fenvalerate tags was 1.07 kg (table 2) while calves from untreated herds gained 0.88 kg ($P<.01$). Yearling heifers with two 8% fenvalerate tags per head gained 0.06 kg more ($P<.05$) each day than untreated heifers. Attaching two tags to the calf did not improve performance when the cow was already tagged with two tags per head. No significant differences ($P>.20$) in wt/day of age or in face and horn fly numbers were detected. This supports data by Harvey and Brethour (1980) that not

every animal in a herd need be tagged to provide horn fly control for the entire herd.

No official counts were made to determine retention for either the fenvalerate tags or the permethrin tags. Very few tags were lost by cattle in the treated herds, with most of those being lost in pastures that contained more brushy areas. No necrosis of the ears was noted with either tag. Seven yearlings had warts appear around the tags which might have been spread by the needle of the tagging pliers.

Trial 2. The variation caused by the different types of pastures and their locations created a need to group the experiment into three treatments: (1) all tagged cattle; (2) cattle consuming a mineral mix containing oxytetracycline; and (3) non-tagged control cattle. Horn flies on the cattle with the fenvalerate tags were reduced 97 to 99% from control herd levels, which were lower than normal during this trial. Cattle consuming the oxytetracycline mineral mix did not show any reduction in horn fly numbers compared to the control cattle. Little difference in face fly numbers was noted between any of the treatments, although their populations were quite low.

No significant differences in adjusted weaning weights were observed between the calves in the three treatment groups ($P>.17$). Adjusted weaning weights for the fenvalerate tagged calves were 202.6 kg, control calves averaged 197.6 kg and calves consuming the oxytetracycline mineral mix averaged

199.8 kg. This lack of significance could be due to the relatively low number of horn flies on the control cattle and differences in the make-up of the various pastures. Eye scores were recorded for all calves to assess eye damage associated with pinkeye. On an adjusted scale from 0 damage to 5 for severe damage, the oxytetracycline mineral mix had the highest score (1.104) but this was not significantly higher than the scores of 0.983 ($P>.07$) for the control calves or 1.009 ($P>.12$) for the fenvalerate tagged calves. Bio-assay tests showed that medicating the mineral mix did not inhibit the growth of fly larvae in the manure.

Trial 3. Results from this study showed that the two 8% fenvalerate tags on each calf provided good horn fly control for both the cow and calf as indicated by the low horn fly numbers. One 8% tag on every other cow controlled horn flies through the early and middle parts of the test, but the duration of control was not as long as the two tag treatment. Incorporating chlortetracycline into the mineral mix did not control flies. As in trial 2, the antibiotic did not inhibit the growth of fly larvae in the manure.

No significant differences in face fly population were noted between any of the treatments; however, calves with two tags had fewer face flies during some of the observation periods.

Adjusted weaning weights of the calves were inversely correlated with horn fly numbers (table 3). Calves with two

tags had average weaning weights of 170.8 kg, which was higher than the 160.3 kg ($P<.05$) for calves from cows with one tag per two cows and greater than the 156.9 kg ($P<.01$) for calves fed chlortetracycline. There was no difference ($P>.49$) between herds 2 and 3. Pinkeye damage scores, on a scale of 0 to 5, were significantly lower ($P<.05$) for calves with two tags (0.122) than the scores for the chlortetracycline treated calves (0.558) or the treatment with one tag per two cows (0.571). As in trial 2, the antibiotic did not reduce the incidence of pinkeye.

Trial 4. Both horn and face fly populations in this trial were lower than normal; however, one 8% fenvalerate tage resulted in a 94 to 100% reduction in horn flies over untreated control cattle ($P<.01$). Horn fly populations for the pour-on and ear tag tape device treatments were also reduced. Face fly numbers for the fenvalerate tagged cattle were not significantly different from control for most of the summer. Little variation was noted between the other treatments.

No significant difference ($P .05$) in adjusted weaning could be found between the three different treatment methods.

The results of these studies indicate that insecticide impregnated ear tags are effective in controlling horn flies on pastured cattle. The horn fly control should provide for higher weight gains in calves and stocker cattle if the cattle are bothered by horn flies. Using the tags at rates

of less than two tags per head will provide the same horn fly control. Face flies will be reduced with the tags, with most of the reduction coming in the early and middle parts of the grazing season. The incidence of pinkeye in calves may also be reduced with these tags.

TABLE 1. EFFECT OF INSECTICIDE IMPREGNATED EAR TAGS ON HORN FLIES AND FACE FLIES ON PASTURED CATTLE TRIAL 1

	No. of horn flies[a]		No. of face flies[a]	
Date	2 tags/hd	Control	2 tags/hd	Control
June 12	0.11(99)[b]	194[c]	0.10(91)[b]	1.07[c]
June 30	0.13(99)[b]	231[c]	0.11(78)[b]	0.51[c]
July 14	0.01(99)[b]	186[c]	0.02(97)[b]	0.69[c]
July 28	0.25(99)[b]	108[c]	0.07(75)[b]	0.28[c]
Aug. 11	0.00(100)[b]	141[c]	0.25(58)[b]	0.59[c]
Aug. 28	1.43(99)[b]	190[c]	0.27(41)[b]	0.46[c]
Sept. 10	2.51(99)[b]	267[c]	1.13(16)[d]	1.34[d]
Sept. 25	16.82(92)[b]	216[c]	0.64(0)[d]	0.32[d]
Oct. 9	10.40(79)[b]	49[c]	0.14(0)[d]	0.00[d]

[a]Values in parenthesis are percentage reductions from control.

[b,c,d]Means within rows (for each fly species) with different superscripts differ (P<.05).

TABLE 2. EFFECT OF FENVALERATE IMPREGNATED TAGS ON WEIGHT GAIN OF BEEF CALVES AND GRAZING HEIFERS TRIAL 1

	Treatments	
	2 tags/hd	Control
Calves		
No. head	47	21
Trial length, days	161	161
ADG, kg	1.07[a]	0.88[b]
Yearling heifers:		
No. head	26	18
Trial length, days	133	133
ADG, kg	0.60[a]	0.55[b]

[a,b]Means within rows with different superscripts differ ($P<.05$).

TABLE 3. EFFECT OF FENVALERATE IMPREGNATED TAGS OR CHLORTETRACYCLINE ON WEIGHT GAIN OF CALVES TRIAL 3

	Treatment		
	2 Fenvalerate tags per calf	1 Fenvalerate tag per 2 cows	Chlortetra-cycline
No. head	34	32	32
Trial length, days	164	164	164
Adjusted weaning wt., kg	170.8[a]	160.3[b]	156.9[b]

[a,b]Means within rows with different superscripts differ (P<.05).

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INSECTICIDE IMPREGNATED EAR TAGS FOR FACE FLY AND HORN FLY CONTROL ON RANGE CATTLE

INTRODUCTION

The use of ear tags impregnated with insecticides has been shown to be effective in controlling horn flies, Hematobia irritans (L.), on pastured cattle (Ahrens and Cocke, 1979). Increases in weight gain for yearling steers resulting from the control of horn flies has also been reported (Harvey and Brethour, 1980). The control of face flies, Musca autumnalis De Geer, has not been as successful as the control of horn flies when the tags have been used in a single pasture (Knapp and Herald, 1981).

The objectives of this study were to evaluate the use of insecticide impregnated ear tags over a large geographical area and determine their effects on horn and face fly population and cattle weight response. Fly migration into the treated area, as well as the extent of the insecticide effect into untreated herds was also studied. Additional studies evaluated the effects of two antibiotics as feed additives on fly population and calf weight response.

EXPERIMENTAL PROCEDURES

Trial 1. A 73.4 square kilometer area, measuring 6.5 x 11.3 km, of range pasture in the Flint Hills area of southeastern Kansas was used during the summer of 1981. The treatment area was divided into 31 separate pastures. All cows in the treatment area (1092) received two tags per head. Most of the calves in the treatment area (695) were also given two tags per head, with 279 calves left untagged. All 247 yearling cattle were tagged, with the exception of 60 head in one pasture that were not tagged. Approximately 9.8 square kilometers of land in the treatment block contained no cattle during the test period.

Two different types of insecticide impregnated ear tags were used in this study. These were two-piece polyvinyl chloride (PVC) tags containing 8% active ingredient (A.I.) fenvalerate and weighing 10 g and two-piece PVC tags containing 10% A.I. permethrin and weighing 9.5 g. The two different tags were not used together in any pasture.

Selected herds in this study were used to calculate the weight gain response due to the control of both horn and face flies. One herd of cross-bred cows and calves were divided so that 47 cows and calves received two fenvalerate tags per head, while the 21 cow-calf mates served as untreated controls.

This trial ran for 161 days. Another herd of yearling Simmental heifers was divided so that 26 heifers received two fenvalerate tags per head while 18 mates served as untreated controls. This trial ran for 133 days. Both the calves and heifers were weighed at the time of tagging (May 22) and at the conclusion of the test. Non-tagged cattle were located in pastures outside the treatment area.

Two groups of cows and calves were used to evaluate the effect of tagging the calves of tagged cows. One herd of cattle was divided so that 24 cows and calves each received two fenvalerate tags per head, while 15 cows were fitted with two fenvalerate tags and their calves remained untagged. The other group of cattle consisted of 24 cows and calves with each cow and calf receiving two permethrin tags, while the remaining 16 cows received two permethrin tags and the calves were not tagged. All four herds of cattle were pastured separately inside the treatment area.

Fly counts for horn and face flies were made at two week intervals starting June 12 and continuing through October 9. Over 1000 cattle outside the treatment area served as control cattle. Their locations varied from adjacent to the treatment area to over 11 kilometers from the treatment area. The time of day that the herds were checked varied throughout the summer. Tagging of the cattle started April 28 and was completed June 10. No pre-treatment fly counts were made.

In addition to fly counts, one or two day old cow pats were collected along transects running through both treatment and control pastures and held in pans covered with a screen, under greenhouse conditions. Emerging flies were collected to give information about fly breeding within the treatment pastures to compare with control areas. The following March, louse and grub counts were taken on one herd of tagged cows and one herd of untagged cows.

Trial 2. Different rate of ear tag use and an antibiotic were used to evaluate fly control and weight gain. Ear tags impregnated with either 5 or 8% fenvalerate of the same design as those in trial 1 were used in this study, which was conducted in north-central Kansas (Washington County). Cross-bred cattle of predominantly Hereford, Charolais, Angus, Gelbvieh and Simmental breeding were used.

The cattle were divided into nine herds. Herd 1 consisted of 39 cow-calf pairs, where each cow received two 8% fenvalerate tags, but the calves remained untagged. Herd 2 was made up of 32 cow-calf pairs where each cow and calf received one 8% fenvalerate tag. Herd 3 consisted of 19 cow-calf pairs with each calf given two 8% fenvalerate tags and the cows left untagged. Herd 4 consisted of 16 cow-calf pairs where only the calf was given one 8% fenvalerate tag. Herd 5 had 40 cow-calf pairs, with each cow and calf receiving two 5% fenvalerate tags. The 63 cows and calves in herd 6 consumed a mineral mix containing oxytetracycline and were

left untagged. The mix contained 2.27 kg of oxytetracycline pre-mix (110 g per kg) per 45.5 kg of mineral mix prior to July 1 and was increased to 4.55 kg of oxytetracycline pre-mix for each 45.5 kg of mineral after July 1. Herds 7, 8 and 9 served as untreated control herds, with 22, 13 and 15 cow-calf pairs, respectively. Most of the pastures were located within a 10 kilometer radius and were similar in type and quantity of available forage.

The cattle were tagged May 15 and fly counts were taken at two to three week intervals starting in mid June and continuing through September. Adjusted weaning weights were calculated for all of the calves at the end of the trial. Pinkeye scores of 0 to 5 (for no eye damage to severe pinkeye damage) were given to all calves. Fresh manure pats were collected from control and oxytetracycline fed cattle and bio-assays were done to determine if the antibiotic inhibited the development of face fly larvae in the manure.

Trial 3. Impregnated ear tags, at two different rates, and an antibiotic were used to investigate face and horn fly control and animal weight response in this study which was conducted in north-central Kansas (Cloud County) during the summer of 1981. Three herds of Hereford cow-calf pairs were used in this study. Herd 1 consisted of 34 cow-calf pairs with two fenvalerate tags given to each calf and no tags on the cows. Herd 2 had 32 cow-calf pairs with one fenvalerate tag attached to half of the cows. Herd 3 was made up of 32

cow-calf pairs that consumed a mineral mix containing chlortetracycline at a concentration of 4.55 kg chlortetracycline pre-mix (50% chlortetracycline and 50% soybean meal) mixed with 45.5 kg of mineral.

Tagging dates, fly counts and weighing procedures were the same as indicated for trial 2. Manure from chlortetracycline treated pastures and control pastures was also collected for bio-assays to investigate the effects of the antibiotic on face fly larvae development.

Trial 4. Ear tags, a pour-on insecticide, and an experimental ear tag device were used in this study in an attempt to control horn flies and face flies. Four herds of Hereford and Hereford-Simmental cross cattle were used at the Range Research unit of Kansas State University located outside of Manhattan. Ear tags containing 8% fenvalerate (as previously described) were used at the rate of one tag per cow in herd 1, which consisted of 57 cows and 38 calves. Herd 2, which had 38 cows and 21 calves, used an experimental permethrin pour-on for horn fly control. Four to five ounces of the pour-on were applied to each cow. Herd 3 consisted of 55 cows and 38 calves, with each cow receiving an ear tag tape device which contained 0.9 g of permethrin in a breakable ampoule. This device was installed around an existing ear tag in each cow. A group of 15 bred yearling heifers were left untreated and served as controls.

The ear tags, ear tag tape devices and pour-on treatments were applied on May 28, with fly counts taken every two to three weeks through early October. On August 18, new ear tag tape devices were placed on the cows in herd 3 because of losses of the original devices. Cows in herd 2 were also given another four to five ml treatment of the pour-on insecticide. Adjusted weaning weights were calculated for comparison purposes for calves in herds 1, 2 and 3.

In all four trials, horn and face fly populations were estimated by visual counts (with binoculars) on 10 to 15 randomly selected animals in each herd. Fly counts were made at various times during the day to minimize time of day variations. Horn fly numbers were estimates of the number of flies on the back, side and belly. Face fly counts included flies resting on or near the animals' eyes only. Mean fly counts were analyzed by Student's t distribution and one way analysis of variance at the 5% level of significance. Due to the abnormally distributed populations between treatments and control animals, the fly count data were analyzed after a log transformation. Animal weight response data were analyzed by a one way analysis of variance test, with means separated by least squares procedures due to unequal treatment numbers.

RESULTS AND DISCUSSION

Trial 1. The level of face and horn fly control provided by the tags is presented in table 1. Horn fly numbers were reduced significantly ($P<.01$) at all observation times during the test. Most of the tagged herds were free of horn flies for the entire 16 week observation period. Although face fly populations were lower than normal, a significant reduction ($P<.05$) in face fly numbers was recorded during June, July and August. No difference in face fly numbers was seen in September or October.

The emergence of face and horn flies from cow pats collected from tagged herds inside the treatment area revealed that horn flies were migrating into the treatment herds from pastures with untagged cattle (table 2). Although the cow pats were collected along transects running through the treatment area, no pattern of fly emergence was detected. Since no horn flies were observed on cattle in the treatment pastures, the tags were killing the incoming flies. Observations in the control pastures both adjacent to the treatment area and farther away show that the reduction in horn fly numbers in the treatment area did not affect horn fly populations in adjacent control pastures.

Horn fly and face fly counts were taken in the pasture in the treatment area where the cattle were not tagged. At two observation periods, both horn and face flies were significantly reduced from nearby control cattle. No significant differences were noted between those cattle and the control cattle during the other observation periods. Horn flies were significantly higher on the untagged cattle in the treatment area than the tagged cattle at all observation periods.

The control levels of face and horn flies resulted in higher weight gains for both calves and yearlings. Daily gains for calves, where both the cow and calf were tagged, were 1.07 kg (table 3) while calves from untreated herds gained 0.88 kg ($P<.01$). Yearling heifers with two 8% fenvalerate tags per head gained 0.06 kg more ($P<.05$) each day than untreated heifers. Attaching two tags to the calf did not improve performance (table 4) when the cows were already tagged with two tags per head. No significant differences in weight/day of age or in face and horn fly numbers were detected. This supports data by Harvey and Brethour (1980) which indicated that only a portion of the herd needs to be tagged to provide horn fly control for the entire period.

During March of 1982 (10 months after tagging) checks for lice and grubs were made on two herds of cows, one herd that had received two 8% fenvalerate tags and one herd that received no treatment. Neither herd was treated for lice or

grubs during the winter months. No conclusive results could be established because the populations of lice were very low on both herds. The eight tagged cows averaged 1.9 grubs per head while control cows averaged 0.3 grubs per head. The difference in grubs could be due to the older age of the control cows (11.5 yrs) compared to the age of the tagged cows (7.5 yrs). Cows with the fenvalerate tags averaged 14.5 lice per head, with all of the lice being Solenopotes capillatus. Control cows averaged 1.9 lice per head, with one louse a Heamatopinus eurysternus, and the rest being Solenopotes capillatus.

Although no counts were made to determine the retention for either the fenvalerate or permethrin tags, few tags were lost by cattle, with most of those being lost in pastures that contained more brushy areas. No necrosis of the ears was noted with either tag. Seven yearlings in one pasture developed warts around the tags, which might have been spread by the needle of the tagging pliers.

Trial 2. The variation caused by the different types of pastures and their locations created a need to group the experiment into three treatments: (1) all tagged cattle; (2) cattle consuming a mineral mix containing oxytetracycline and (3) non-tagged cattle. Horn flies on cattle with the fenvalerate tags were reduced 97 to 99% from control herd levels (table 5). Cattle consuming the oxytetracycline mineral mix did not show any reduction in horn fly numbers

compared to control cattle. Little difference in face fly numbers was noted between any of the treatments, although their population was quite low.

Adjusted weaning weights for the calves (table 6) were not significantly different between the three treatment groups (P>.17). Adjusted weaning weights for the fenvalerate tagged calves averaged 202.6 kg while control calves averaged 197.6 kg and calves consuming the oxytetracycline mineral mix averaged 199.8 kg. This lack of significance could be due to the relatively low number of horn flies on the control cattle and differences in pastures. Eye scores were made on all calves to assess eye damage associated with pinkeye. On an adjusted scale from 0 damage to 5 for severe damage, the oxytetracycline treatment had the highest score (1.10), but this was not significantly higher than scores of 0.98 (P>.07) for the control calves or 1.01 (P>.12) for the fenvalerate tagged calves.

Bio-assay tests on manure collected from control and oxytetracycline treated pastures showed no difference in the survival of face fly larvae between the two treatments (table 7). (Percent corrected mortality, using Abbott's formula, ranged from 4.2 to 27.4% for pupating larvae and from -43.8 to 23.2% for adults emerging.)

Trial 3. Two 8% fenvalerate tags on each calf produced excellent horn fly control for both the cow and calf (table 8). One 8% fenvalerate tag on every other cow controlled

flies throughout the early and middle parts of the test but did not significantly reduce flies during the last observation period. Incorporating chlortetracycline into the mineral mix did not appear to offer any horn fly control. Bio-assay tests on manure from non-treated and chlortetracycline treated herds showed no reduction in larvae or fly development (table 7). No significant differences in face fly populations were noted between any of the treatments.

There was an inverse correlation between adjusted weaning weights and horn fly numbers (table 9). Calves with two fenvalerate tags had average weaning weights of 170.8 kg, which was higher than the 160.3 kg ($P<.05$) for one tag on every other cow, and greater than the 156.9 kg ($P<.01$) for calves fed chlortetracycline. Pinkeye damage scores on a scale of 0 to 5 were significantly lower ($P<.05$) for calves with two tags (0.11) than the scores for the chlortetracycline treated calves (0.56) or the treatment with one tag per two cows (0.57). As in trial 2, the antibiotic did not reduce the incidence of pinkeye.

Trial 4. One fenvalerate tag per head resulted in a 94 to 100% ($P<.01$) reduction in horn flies over untreated control cattle (table 10). Horn fly populations were significantly reduced at some observation times for the pour-on and the ear tag tape device treatments. Face fly numbers for the fenvalerate tagged cattle were not significantly different

from the control cattle for most of the test period. Very little variation was noted between other treatments.

The results of these studies indicate that insecticide impregnated ear tags are effective in controlling horn flies on pastured cattle. The horn fly control should provide for higher weight gains in calves and stocker cattle if the cattle are bothered by horn flies. Using the tags at rates of less than two tags per head will provide the same horn fly control. Face flies will be reduced with these tags, with most of the reduction coming in the early and middle parts of the grazing season. The incidence of pinkeye in calves may also be reduced when these tags are used.

TABLE 1. EFFECT OF INSECTICIDE IMPREGNATED EAR TAGS ON HORN FLIES AND FACE FLIES ON PASTURED CATTLE TRIAL 1

	No. of horn flies[a]		No. of face flies[a]	
Date	2 tags/hd	Control	2 tags/hd	Control
June 12	0.11(99)[b]	194[c]	0.10(91)[b]	1.07[c]
June 30	0.13(99)[b]	231[c]	0.11(78)[b]	0.51[c]
July 14	0.01(99)[b]	186[c]	0.02(97)[b]	0.69[c]
July 28	0.25(99)[b]	108[c]	0.07(75)[b]	0.28[c]
Aug. 11	0.00(100)[b]	141[c]	0.25(58)[b]	0.59[c]
Aug. 28	1.43(99)[b]	190[c]	0.27(41)[b]	0.46[c]
Sept. 10	2.51(99)[b]	267[c]	1.13(16)[d]	1.34[d]
Sept. 25	16.82(92)[b]	216[c]	0.64(0)[d]	0.32[d]
Oct. 9	10.40(79)[b]	49[c]	0.14(0)[d]	0.00[d]

[a]Values in parenthesis are percentage reductions from control.

[b,c,d]Means within rows (for each fly species) with different superscripts differ (P<.05).

TABLE 2. EFFECT OF INSECTICIDE IMPREGNATED EAR TAGS ON FLY EMERGENCE FROM COW PATS. TRIAL 1.

	Treatment Pastures	Control Pastures
Face Flies		
No. cow pats	60	46
No. with flies	13	13
No. total flies	40	101
Percent of cow pats with flies	21.7	28.3
Horn flies		
No. cow pats	60	46
No. with flies	13	32
No. total flies	60	762
percent of cow pats with flies	21.7	69.6

TABLE 3. EFFECT OF FENVALERATE IMPREGNATED TAGS ON WEIGHT GAIN OF BEEF CALVES AND GRAZING HEIFERS TRIAL 1

	Treatments	
	2 tags/hd	Control
Calves		
No. head	47	21
Trial length, days	161	161
ADG, kg	1.07[a]	0.88[b]
Yearling heifers:		
No. head	26	18
Trial length, days	133	133
ADG, kg	0.60[a]	0.55[b]

[a,b]Means within rows with different superscripts differ ($P<.05$).

TABLE 4. EFFECT OF DOUBLE TAGGING OR NOT TAGGING CALVES, WHEN ALL COWS ARE DOUBLE TAGGED, ON CALF WEIGHT GAIN. TRIAL 1

	2 tags/cow 2 tags/calf	2 tags/cow calf not tagged
Fenvalerate tags:		
No. head	24	16
Trial length, days	164	164
Wt/day of age, kg	1.05[a]	1.00[a]
Permethrin tags:		
No. head	24	15
Trial length, days	122	122
Wt/day of age, kg	1.10[a]	1.09[a]

[a]Means within rows with different superscripts differ ($P<.05$).

TABLE 5. EFFECT OF FENVALERATE TAGS AND OXYTETRACYCLINE ON HORN FLIES AND FACE FLIES ON PASTURED CATTLE. TRIAL 2.

Date	No. of horn flies[a]			No. of face flies		
	Fenvalerate tagged	Oxytetra-cycline	Control	Fenvalerate tagged	Oxytetra-cycline	Control
June 19	0.24(98)^{b}	63.53(0)^{c}	11.43^{d}	1.48(0)^{b}	0.29(78)^{c}	1.33^{b}
July 8	0.49(98)^{b}	45.52(0)^{c}	27.94^{c}	0.23(63)^{b}	0.30(52)^{b}	0.62^{b}
July 31	0.41(99)^{b}	50.27(28)^{c}	70.24^{c}	0.36(43)^{b}	0.20(68)^{b}	0.63^{b}
Aug. 19	0.04(99)^{b}	143.62(0)^{c}	110.42^{d}	0.88(0)^{b}	0.33(0)^{bc}	0.14^{c}
Sept. 17	2.15(97)^{b}	126.63(0)^{c}	77.72^{c}	1.83(0)^{b}	1.17(0)^{b}	0.84^{b}

[a]Values in parenthesis are percentage reductions from control.

b, c, d Means within rows (for each fly species) with different superscripts differ ($P<.05$).

TABLE 6. EFFECT OF FENVALERATE IMPREGNATED TAGS OR OXYTETRACYCLINE ON WEIGHT GAIN OF CALVES. TRIAL 2.

	Treatment		
	Fenvalerate tags	Oxytetracycline	Control
No. head	149	62	50
Trial length, days	126	126	126
Adjusted weaning wt., kg	202.6[a]	199.8[a]	197.6[a]

[a] Means within rows with different supersctipts differ (P<.05).

TABLE 7. THE EFFECT OF ORAL ANTIBIOTICS ON FLY LARVAE SURVIVAL IN CATTLE MANURE. TRIALS 2 AND 3.

	Survival[a]		
	Control	Oxyterta-cycline	Chlortet-racycline
Study 1:			
Pupae	27.0	22.3	19.6
Adult	25.0	21.1	16.8
Study 2:			
Pupae	18.7	13.5	20.9
adult	16.7	12.8	20.3
Study 3:			
Pupae	21.7	20.7	20.3
Adult	14.5	20.7	19.0

[a] Out of 30 possible.

TABLE 8. EFFECT OF FENVALERATE TAGS AND CHLORTETRACYCLINE ON HORN FLIES AND FACE FLIES ON PASTURED CATTLE. TRIAL 3.

	No. of horn flies			No. of face flies		
Date	Fenvalerate 2 tags/calf	Fenvalerate 1 tag every other cow	Chlortet-racycline	Fenvalerate 2 tags/calf	Fenvalerate 1 tag every other cow	Chlortet-racycline
June 19	1.16^{a}	3.24^{b}	83.31^{c}	1.50^{a}	1.50^{a}	1.00^{a}
July 8	2.80^{a}	0.82^{a}	143.71^{b}	1.40^{a}	0.71^{a}	1.99^{a}
July 31	0^{a}		124.62^{b}	1.25^{a}		0.57^{a}
Aug 19	0^{a}	0.27^{a}	144.83^{b}	2.80^{a}	4.50^{a}	4.10^{a}
Sept 17	2.36^{a}	46.45^{b}	283.88^{b}	1.15^{a}	3.09^{b}	3.82^{b}

^{a,b,c}Means within rows (for each fly species) with different superscripts differ ($P<.05$).

TABLE 9. EFFECT OF FENVALERATE IMPREGNATED TAGS OR CHLORTETRACYCLINE ON WEIGHT GAIN OF CALVES TRIAL 3

	Treatment		
	2 Fenvalerate tags per calf	1 Fenvalerate tag per 2 cows	Chlortetra-cycline
No. head	34	32	32
Trial length, days	164	164	164
Adjusted weaning wt., kg	170.8[a]	160.3[b]	156.9[b]

[a,b]Means within rows with different superscripts differ (P<.05).

TABLE 10. EFFECT OF FENVALERATE TAGS, PERMETHRIN EAR TAG TAPE DEVICES AND PERMETHRIN POUR-ON ON HORN FLIES AND FACE FLIES ON PASTURED CATTLE. TRIAL 4.

	No. of horn flies[a]			
Date	1 fenvalerate tag/hd	Ear tag tape device	Permethrin pour-on	Control
June 24	0(100)^{b}	12.27(14)^{c}	0.52(96)^{b}	14.20^{c}
July 10	0(100)^{b}	6.19(0)^{c}	3.74(0)^{cd}	1.36^{bd}
July 23	0.27(94)^{b}	21.56(0)^{c}	5.98(0)^{d}	4.52^{d}
Aug. 14	0(100)^{b}	25.66(79)^{c}	36.88(69)^{c}	120.23^{d}
Aug. 26	0(100)^{b}	0(100)^{b}	0(100)^{b}	35.41^{c}
Sept. 13	0(100)^{b}	0.12(99)^{b}	0(100)^{b}	12.21^{c}
Sept. 22	1.06(99)^{b}	4.90(94)^{b}	5.32(94)^{b}	84.90^{c}
Oct. 6	0(100)^{b}	0(100)^{b}	0(100)^{b}	0.86^{c}
	No. of face flies[a]			
Date	1 fenvalerate tag/hd	ear tag tape device	Permethrin pour-on	Control
June 24	0^{b}	0^{b}	1.00^{c}	0^{b}
July 10	0.60(43)^{b}	0.70(50)^{b}	0.88(57)^{b}	1.40^{b}
July 23	0.20(0)^{b}	0.20(0)^{b}	0.11(0)^{b}	0^{b}
Aug. 14	2.80(0)^{b}	2.00(0)^{b}	1.40(7)^{b}	1.50^{b}
Aug. 26	1.40(0)^{b}	4.20(0)^{b}	0.22(78)^{d}	1.00^{bd}
Sept. 13	0.30(84)^{b}	1.10(41)^{bc}	1.36(28)^{cd}	1.88^{cd}
Sept. 22	0.10(0)^{b}	0.15(0)^{b}	0.11(0)^{b}	0^{b}
Oct. 6	0.15(0)^{b}	0(100)^{b}	0(100)^{b}	0.22^{b}

[a] Values in parenthesis are percentage reductions from control.

[b,c,d] Means within rows (for each fly species) with different superscripts differ ($P<.05$).

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THE EFFECT OF INSECTICIDE IMPREGNATED EAR TAGS ON CATTLE WEIGHT GAIN AND FLY POPULATION

by

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Four trials using ear tags impregnated with insecticide were used to control horn flies, Heamatobia irritans, and face flies, Musca autumnalis De Geer, on pastured cattle. In trial 1 ear tags impregnated with 8% fenvalerate or 10% permethrin essentially eliminated horn flies ($P<.05$), and reduced face fly populations, when the tags were used over a large geographical area. Average daily gain for calves when both cows and claves were double tagged was 0.19 kg more ($P<.01$) than calves from an untreated herd. Double tagged yearling heifers gained 0.05 kg a day more ($P<.05$) than untreated heifers. In trial 2 fenvalerate impregnated tags significantly ($P<.01$) reduced horn fly numbers compared to oxytetracycline fed or non-tagged cattle. Face flies were not effected by tagging or feeding oxytetracycline. Adjusted weaning weights were not significantly different between the three treatments (202.6, 199.8 and 197.6 kg for the tagged, oxytetracycline fed and control cattle, respectively). Trial 3 compared fenvalerate tags at two different levels and chlortetracycline in a mineral mix as treatments. The fenvalerate tags used at two tags per calf reduced horn fly numbers significantly ($P<.01$) over the chlortetracycline cattle. One fenvalerate tag on every other cow reduced horn fly numbers from the chlortetracycline fed cattle for most of the study. No significant difference ($P>.15$) in face fly populations were observed between the three treatments for the first four observation periods. Adjusted weaning weights for calves

with two fenvalerate tags was significantly higher ($P<.05$) than the other two treatments (170.8, 160.3 and 157.6 kg for two tags per calf, one tag on every other cow and chlortetracycline, respectively). In trial 4, on fenvalerate tag per cow eliminated horn flies ($P<.01$) over control cattle. Ear tag tape devices and a pour-on, both containing permethrin, also offered significant ($P<.05$) horn fly control for most of the study. Face fly populations were not significantly reduced between treatments.