THE PERFORMANCE OF PHENOTHIAZINE TREATED CATTLE

by

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INTRODUCTION

It is generally recognized that cattle, as well as other types of livestock are parasitized by worms. The kind of worms are recognized as well as the part of the digestive tract that is preferred by the different species.

It is true that worms seldom cause cattle deaths, but it is believed by some that they extract a heavy toll on gains and wasted feed. Swanson, et. al. (10) of Florida cited the stomach worm as a severe blood sucker. It has been observed to change position frequently, leaving in its wake a series of feeding points that continue to bleed for several minutes after the worm has moved on. The immature stage of the stomach worm burrows in to the stomach lining, causing extreme irritation. According to Swanson, et. al. the life cycle of these stomach and intestinal worms is direct. Adult worms mate within the host and the females produce enormous numbers of microscopic eggs which are passed out with the manure. Under suitable conditions of temperature and moisture each egg develops into an infective immature worm. Cattle become infested by grazing pastures harboring these infective stages. After the invading worms reach the location in the digestive tract of the host, most suitable to them (stomach or intestines), they develop to sexual maturity, thus completing the life cycle.

A number of events may be leading to a greater infestation of cattle by worms. The more extensive use of pond water for cattle on range and farm pastures would tend to make environmental

conditions more favorable for worms. Greater movement of cattle from one area to another with faster transportation would tend to spread worm eggs over a wider range. The more intensive use of seeded pasture would favor worm development, especially in the heavy rainfall areas. And, last but not least, the continued expansion of cattle numbers would tend to increase the parasite problem on many farms and ranches.

The sheepman has long learned that controlling internal parasites is a must in his management practices. The trend is to the use of phenothiazine in place of the copper sulfate, blue vitrol treatment first used for worm control in sheep.

Phenothiazine is a newer anthelmintic on the market gaining prominence in recent years. It is believed to be more effective for worm control and easier to administer under various conditions. It is used as a powder mixed with feeds or mineral or in a drench, pill, or bolus form. According to E. I. DuPont DeNemours & Co., (inc.) (15), phenothiazine is made in the following three products:

> Phenothiazine NF Powder is a finely ground light gray-green powder, insoluble in water. It meets National Formulary specifications, having a melting point of 179° C. Being an unmodified form of the drug, this grade is the most widely used and is suitable for making drench suspensions, boluses, capsules, or mixing with feed, salt or minerals.
>
> Phenothiazine Drench Compound No. 4 contains 98.5% phenothiazine and 1.5% wetting and conditioning agents. It is designed for formulators to sell as a dry powder, with directions for the user to mix with water for use as a drench for cattle, sheep, goats, and horses. Since this grade does not remain in suspension for a long period of time, it should be sold as a powder for mixing with water on the farm.
>
> Phenothiazine NF Purified is the same as NF powder except that it is light yellow in color and contains fewer

impurities. Purified phenothiazine is equivalent, pound for pound, to NF powder in anthelmintic effectiveness. Some users prefer the purified merely because it can be colored to manufacture a "pink drench".

There are several systems of beef production practiced in Kansas. Where grass is more abundant, in the Flint Hills and the Southwest short grass area, cow herds are predominate and stocker-feeder calves produced. In all sections of the state, replacement cattle are purchased to utilize roughage grass, and grain. The systems are generally referred to as (1) deferred fed steers or heifers, (2) winter and grazing, and (3) grazing alone in some areas producing feeders and grass fat steers.

A large percent of replacement calves and yearlings purchased by Kansas stockmen for these beef production programs are raised in the southwest plains areas of Texas, Colorado, Oklahoma, New Mexico, and southwest Kansas. The replacement cattle purchased to utilize roughage and grass in the "Flint Hills" area are generally of plainer grade and on the yearling order. They originate from all sections of the plains and in many cases are assembled cattle produced by smaller cow herds. It is generally believed that calves produced in the semi-arid southwest plains area will not be as heavily parasitized as calves raised in the humid southeast sections of the country.

Cattlemen have often asked the question of Kansas Experiment Station and Extension Animal Husbandmen, "are replacement

cattle purchased in the west and southwest parasitized with worms and if so would treatment pay"? Many of the experiments conducted by the Animal Husbandry Department of Kansas State College in past years have been with weanling steer and heifer calves purchased from ranches in Texas, Oklahoma, Colorado, and southwest Kansas. These experimental cattle have been typical of cattle used by farmers and ranchers for commercial production throughout Kansas; consequently, they were ideal experimental subjects for studying some of the practical aspects of parasitism of beef cattle in this area.

The experiments reported herein were designed to study the degree of parasitism and the effect of treatment with phenothiazine on replacement steer and heifer calves purchased from west Texas and southwest Kansas. Phenothiazine was used in this experiment as an anthelmintic because it is generally believed to be effective in controlling worms in cattle and sheep. In addition it is an anthelmintic which is easily administered and has practically no ill effects on the animals.

REVIEW OF LITERATURE

The published literature concerning parasitism of domestic animals is so voluminous that no attempt will be made to give a complete review. Only those reports which are pertinent to this study will be considered.

Roberts et. al. (9) found that in calves six to twelve months old in which Hoemonchus contortus was the dominant

species, a count of 1000 EPG[1] or more was frequently accompanied by serious symptoms of haemonchosis. In calves of this age, 500 EPG to 700 EPG was considered to represent a border line infestation which, when combined with B. radiatus (300 EPG or more) or B. phlebotomus (300 EPG or more), or both, become definitely dangerous. This worker observed that a yearling calf produces about 12,000 grammes of faeces daily, and a count of 2000 EPG is equivalent to a daily egg output of 24,000,000 eggs. A female H. contortus lays 5,000 to 10,000 eggs daily which means an infestation of 4800 to 9600 worms (males and females). In 12 month old animals, counts of 500 to 800 EPG were found to be indicative of a highly pathogenic infestation.

The EPG count was used by Herlich and Porter (6) in Alabama to determine the effect of controlling internal parasites of cattle by free-choice administration of phenothiazine. A total of 28 parasitized grade Jersey calves from four to nine months of age were placed on the pastures by pairs at various intervals during the experiment. The calves getting the mineral containing phenothiazine consumed 32 grams daily. The control calves consumed an average of 31 grams daily indicating that the medicated mixture was as palatable as the non-medicated. The treated calves were placed on pasture corresponding to pasture which the controlls grazed and given a treatment of 60

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[1]EPG--this is the abbreviation for worm eggs per gram of fecal material. The techniques used in making these counts are described on page 13in procedure.

grams of phenothiazine. In addition they had access to a 1:9 phenothiazine mineral mixture consisting of three parts each of salt bone meal and crushed limestone and one part of phenothiazine by weight. The controlled calves were given the same mixture minus the phenothiazine. The following table summarizes the EPG count at the conclusion of the experiment.

Table 1. (Summary) Number of worms recovered from calves large intestines receiving medicated and unmedicated mineral mixture on pastures A & B.

	Abomasum			Small Intestine			Large Intestine	
	H. contortus	O. ostertagi	T. Akeri	Immature worms	C. punctatum	N. helvetianus	Immature worms	O. radiatum
Treated	41	1823	86	40	15589	5549	1400	5
Controls	623	3169	194	1346	20514	1346	886	156

The results of the experiment indicated that the level of parasitic infestation of calves with the common stomach worm and the nodular worm was effectively controlled by the free choice administration of phenothiazine even though the pasture was continuously grazed for two years. There was no significant difference in average weight gained; the controls averaging a gain of 81 pounds and the treated 91 pounds. No doubt this can be explained by the fact that none of the infestations reached a level that is commonly regarded as pathogenic.

Andrews et. al. (1) in diagnosing cattle during 1952 and 1953 in Georgia from 10 farms grazing from 14 to 900 head each

concluded the following facts: (1) During the three years of observation clinical parasitism in cattle on south Georgia farms almost tripled. (2) The number of worm eggs per gram of feces is not a dependable aid in ascertaining which animals are suffering from parasitosis. (3) The anthelmintics now available for treating cattle are not efficient in removing certain pathogenic parasites from the digestive tract of cattle. (4) The contents of the digestive tract of bovines suspected of suffering from clinical parasitism must be screened for parasitic worms before a positive diagnosis can be made. Four factors on the ten farms observed as facts of importance in increasing parasites were:

1. Sole source of drinking water was pond or water holes.
2. Lack of adequate supplemental feed.
3. Overstocking.
4. Imported cattle more susceptible to parasites than natives.

Foster (3) in 1952 field trials with phenothiazine-salt (1-10) mix on various types of pasture found that consumption of the medication was insufficient in all instances to provide effective control. A 1-15 mixture tested for three months on a herd of 300 weaner calves on irrigated Ladino clover pasture did not prevent scouring, loss of condition, and high counts of "stomach worm eggs", but calves responded promptly to two-gram doses of phenothiazine. Repetition of the experiment gave the same unsatisfactory results.

Harwood (5) in Ohio used a phenothiazine salt 1-10 mix on Hereford beef calves that were grazed on bluegrass and white clover. In 1943, 13 steers were provided with medicated salt and 12 with plain salt for 113 days. The following year 14 were on medicated salt and 15 were on plain salt for 144 days. The consumption of phenothiazine was four to five grams daily by 600 pound animals. This was sufficient to achieve direct anthelmetic effect. Of greater significance was the fact the treated calves gained more weight than those on plain salt, showed lower egg count during the experiment, and fewer worms on autopsy. Infestations were moderate and none of the animals suffered from clinical parasitism, yet treated calves gained on the average 20½ pounds more than the untreated in 1943, and 15.3 pounds more in 1944.

In a report by the Chief of the Bureau of Animal Industries in 1945, (13), trials gave generally promising results with 1:19 mixture of phenothiazine and mineral supplement. Initial trials on separately pastured calves indicated that a daily intake of 0.5 to 2.5 grams per animal was the desired goal. Other experiments suggested that a mineral base supplement might be more satisfactory than plain salt, and that a 1-10 mixture might be too high.

A Bureau of Animal Industry report in 1952 (14) by the Chief on further experience cites efficient control of stomach worms in calves maintained on 10 percent (1:9) phenothiazine-mineral mixture. Post mortem data on three treated and three

untreated calves that had been kept from six weeks to three months on the experiment showed sixty times more stomach worms in untreated calves. Stomach worm infestation progressively decreased in animals receiving medication, a result which again suggested delayed anthometic effect of small doses.

Porter et. al. (8) reported in 1941 that results of tests indicated that 0.2 grams of phenothiazine per pound of body weight is more than ample dosage for removal of stomach worms and nodular worms. The drug was equally effective when given in capsules or in grain mixtures, but the capsule method was more convenient to use. The effectiveness of the drug was judged by the reduction in the number of worm eggs per gram of feces. Doses of 40 to 60 grams given to heavy parasitized yearlings weighing from 175 to 300 pounds were, except in one animal, very effective against gastro-intestinal nematods. Doses of 5-15 ounces of a 1.5 percent copper-sulphate and 0.6 percent nicotine-sulphate solution were ineffective as an anthelmintic when compared with results obtained with phenothiazine given at a dose rate of about 0.2 grams per pound of body weight. The data indicated that although the cooperids might not be removed immediately by phenothiazine, general physical improvement of the host following loss of other harmful parasites may result in gradual elimination of these parasites. It was indicated that serious reinfection of cattle one to two years old may not take place for at least three or four months if moved to clean ground following treatment.

The Veterinary Staff in the Department of Agriculture in

1953 (12) recommended phenothiazine as an effective treatment for trichostrongyle infestation. They recommended treatment as follows: adult cattle, 1 ounce; yearlings, 3/4 ounce; calves, 6 months old 1/2 ounce; calves 4 months old, 1/3 ounce. It might be necessary to repeat the treatment after an interval of ten to fourteen days. In some cases when the symptoms are temporarily alleviated, but very soon return, it is necessary to increase the dose rate as follows: adult cattle, 2 ounces; yearlings, 1½ ounces; calves 6 months, 1 ounce; calves 4 months, 3/4 ounce. These amounts on certain individuals may approximate the toxic or poisonous level. It is therefore recommended that these doses be divided into three equal parts, each part to be given at 24 hour intervals. After administration phenothiazine changes chemically, and the substance formed renders the body sensitive to the action of the sun's rays. This condition is known as photosensitization and is a severe sunburn. The eyes most commonly suffer from this effect. The surface of these organs becomes bluish-white and opaque. The membraneous linings of the lids appear red and inflamed, and puss-like discharge drains away from the eyes. To prevent photosensitization, dose as recommended and only during dull weather. The effected animals should be placed in a dark shed and provided with ample food and water. Otherwise they should be left strictly alone.

Swanson et. al. (10) lists the symptoms of cattle infected with large numbers of worms as severe emaciation, anemia, weakness, dejected appearance, rough hair coat, "pot belly" and "scours".

In some instances, especially where stomach worms or hook worms are involved, "bottle jaw" (edematour swelling under the jaw) is commonly observed; bloody or dark feted feces usually indicates the presence of hook worm infection. Under experimental conditions, phenothiazine in doses of 20 grams per hundred pounds of body weight has been shown to be effective in removing the adult stages of most of the important species of worms. Under Florida conditions this did not prove too toxic for general use, presumably, because of mineral deficiencies, anemia, or inadequate nutrition. The Florida Agricultural Experiment Station recommends the administration of 10 grams of phenothiazine per 100 pounds of body weight, (maximum dose is 60 grams per animal), and to repeat the treatment in three weeks. The 21 day interval between treatments being necessary because phenothiazine is effective only against the parasites which are adults at the time of treatment. It does not remove the immature parasites within the three week period. Most of the immature stages will have matured and be removed by the second treatment.

Under Florida conditions Swanson found that ordinary feeds such as snapped corn, dairy feeds, molasses-base feed, fed alone or fed with citrus pulp served as a good means of getting cattle to take the necessary quantity of phenothiazine. A cottonseed meal and salt mixture, (four pounds of cottonseed meal and one part of salt) was also satisfactory as long as the phenothiazine did not exceed one gram per pound of mixture.

With the phenothiazine salt and phenothiazine mineral mixtures used in Florida consumption was erratic and unpredictable. It was found that cattle did not consume phenothiazine readily in feed or otherwise until ten days after a theraputic dose. Phenothiazine had no direct effect on lung worm, liver fluke, or tapeworm infections.

Ortlepp (7) in recommending phenothiazine for control of internal parasites in South Africa prescribed a dose for full grown cattle 30-40 grams and for calves 20-30 grams. He prescribed the treatment in the form of a paste prepared by rubbing four pounds of phenothiazine through a sieve to remove any lumps, and then stirring into five pints of clean, cold water to form a thin paste.

The University of Wisconsin Extension Circular 493 (14) reports that phenothiazine powder is not palatable to cattle in one ounce or two ounce amounts and recommends that the therepetic treatment be given in boluses, or suspended in fluid with a drenching syringe or a stomach tube.

Grist and Turk (4) recommends three treatments for control of internal parasites in cattle, the copper-sulphate solution, 1 3/4 percent giving each animal not more than 1 cc per pound body weight up to 500 pounds. Weak or heavy parasitized animals should receive only one-half to three-fourths cc per pound. One ounce of black-leaf 40 added to each gallon of copper-sulphate solution increases its efficiency. Tetrachlorethylene given at the rate of 55 cc per one hundred pounds weight either in

mineral oil or in gelatin capsules, compared favorably with copper-sulphate for stomach worms. Phenothiazine was the most effective recommended treatment. The recommended dose of 10-12 grams of powder per 100 pounds of live weight with not more than 60 grams or 2 ounces of powder to any animal regardless of weight.

PROCEDURE AND EXPERIMENTS

In selecting cattle for the phenothiazine worming test it was decided to superimpose this treatment on cattle being used on other tests rather than specifically designating two lots for this experiment. One advantage of this procedure was the opportunity to test larger numbers than would otherwise be possible. A disadvantage was the variance between lots, each being fed a different ration. For this reason it was concluded that each lot composed of ten head would be divided as nearly equal in weight as possible. This allowed five head in each lot for treatment and five head for control. Each animal was hot iron branded on the hip with a number for individual identification.

To determine the degree of parasitism, composite and individual fecal samples were collected. The collections were made prior to treatment and during the course of the experiment following the treatment. The composite sample was composed of equal quantities of fecal material from the five non-treated animals and the same for the five treated animals. The fecal

material for a composite sample was thoroughly mixed before the 10 gram sample was weighed out for the EPG count.

The Department of Pathology of Kansas State College cooperated by making the EPG counts of fecal samples collected during the experiment. The EPG count technique used by the Department of Pathology in determining the degree of parasitism was as follows: Ten grams of fecal material was weighed into a 300 cc erlenmeyer flask and diluted to 300 cc with tap water. The flask was stoppered and homogenized. From this mixture 15 cc was strained through a double layer of cheese cloth into a test tube and centrifuged at 1500 R.P.M. for three to five minutes. The Supernatant fluid was poured off and the sediment containing parasitic ova was resuspended in zinc sulfate solution with a specific gravity of 1.18 to 1.22. The tube was filled with flotation solution and recentrifuged in the same manner as before. The tube was placed in a rack and sufficient flotation solution added to bring the top of the meniscus above the top of the edge of the tube. A cover slip was set on top of the tube and allowed to remain three minutes. The cover slip was then transferred carefully to a slide and all of the eggs under cover on glass were counted. The EPG count was obtained by multiplying actual count by two.

The phenothiazine boluses used for treatment in this experiment were prepared by the Veterinary Department of Kansas State College. The administration was orally and little difficulty experienced. Several heifers would cough up a bolus

but otherwise the administration was a process any experienced stockman could perform.

The cattle in the experimental lots were weighed at the beginning and end of the test so the effect of the treatment on gains could be measured.

Experiment I

The first experiment was conducted during the winter of 1953-54 with heifer calves. The Hereford heifers were raised near Snyder, Texas, and purchased by the Department of Animal Husbandry of Kansas State College on December 1, 1953. The heifers were number branded, weighed, and divided into six lots of equal weight and grade. The rations fed the six lots during the 137-day wintering period from December 17, 1953, to May 3, 1954, were as follows:

Lot I - Prairie Hay, CSM-1#, Milo 2.59#, Steamed Bonemeal and salt.

Lot II - Ground Corn Cobs, CSM-1.5#, Milo 2.26#, Steamed Bonemeal and salt, and Vitamin A.

Lot III - Alfalfa silage preserved with cornmeal, ground shelled yellow corn-1.45#.

Lot IV - Alfalfa silage-non-preserved, ground shelled yellow corn-3#.

Lot V - Alfalfa silage-non-preserved, CSM-1#, ground yellow shelled corn-2#.

Lot VI - Alfalfa hay, ground yellow shelled corn-3#.

Fecal samples were collected on December 21 and December 29, 1953. These were composite fecal samples collected to determine the degree of parasitism of the heifers before treatment.

Five heifers in each lot, thirty head in all were treated with phenothiazine on January 14, 1954. The treated heifers were given two boluses containing 60 grams of phenothiazine powder orally with a bolus gun. Individual fecal samples for EPG counts were collected just prior to the administration of the drug. Fecal samples were again collected on February 11, 1954, from each heifer. Following this collection it was concluded that composite fecal samples would be collected from lots 1 and 3 and individual samples from lot 4. These fecal samples were collected on March 9 and April 9, 1954.

Results of Experiment I

The average EPG count of the pre-treatment fecal samples collected on December 21 and December 29, 1953, is given in Table 1.

The average EPG count of these pre-treatment samples taken eight days apart was 156. Roberts et. al. (9) cite levels of 500 or more EPG as pathogenic and at the level found in this experiment worthy of treatment.

The EPG count of the individual fecal samples taken at the time of treatment are reported in appendix Table 7. The results of the EPG count of samples taken on February 11, 1954, following treatment are reported in appendix Table 8. Although fecal collections were taken individually at the time of treatment and on February 11, 1954, reports are incomplete on the EPG counts due to the lack of help in the Department of Pathology.

Table 1. The EPG count of the composite fecal samples collected before treatment.

Lot No.	Stomach worm EPG	Hookworm EPG	E. bovis coccidia	Tapeworms
	Samples taken December 21, 1953			
1	238			
2	170		34	
3	273			
4	93	2	18	
5	64		6	
6	74		6	48
	Samples taken December 29, 1953			
1	170	2		
2	92			
3	80	6		
4	280	10		
5	148	8		
6	176			

For this reason it was concluded that composite fecal samples of lots 1 and 3 and individual fecal samples of lot 4 would be collected on March 9 and April 9, 1954. The EPG counts of these collections are given in Tables 2 and 3.

Table 9 in the appendix gives the initial and final weights of the heifers treated and not treated and the individual and total gains of the heifers in each lot on the basis of treated and non-treated heifers. A summary of the gains is given in Table 4.

The thirty treated heifers made an average daily gain of 1.32 pounds per head, while the thirty non-treated heifers made an average daily gain of 1.29 pounds per head. The treated heifers gained 4.0 pounds more than the non-treated heifers in

the 137 days dry lot wintering period.

Table 2. EPG count of fecal samples collected March 9, 1954.

Lot No.	Animal	Stomach worm	E. bovis coccidia	Tapeworms
1	Non-treated[1]	12	10	42
1	Treated[2]	8		22
3	Treated[3]	68		30
3	Non-treated[4]	38		
4	23*	18		
	29	76		26
	43	4		
	48*	22	6	
	51*	38	6	162
	62*	8		
	67	8		
	88*	6	78	
	98	10		
	99	46		

[1]Composite of 5 non-treated animals.
[2]Composite of 5 treated animals.
[3]Composite of 5 treated animals.
[4]Composite of 5 non-treated animals.
*Treated animals.

Table 3. EPG count of fecal samples collected on April 9, 1954.

Lot No.	Animal	Stomach worm	*E. bovis* coccidia	Tapeworms
1	Non-treated[1]	8	12	8
1	Treated[2]	2	6	4
3	Treated[3]	22	4	104
3	Non-treated[4]	14	4	
4	23*	34		
	29	400		
	43	4	4	
	51*	84	12	182
	62*	2		
	67	14		
	88*	18	6	
	98	24	8	
	99	50		
	48*	6		

[1]Composite of 5 non-treated animals.
[2]Composite of 5 treated animals.
[3]Composite of 5 treated animals.
[4]Composite of 5 non-treated animals.
*Treated animals.

Table 4. The average total gains and the average daily gains for the treated and non-treated heifers in each lot for the 137 day wintering period December 17, 1953 to May 3, 1954, in the 1953-54 test.

Lot No.	Average total gain per head	Average daily gain per head
1 Treated	189	1.38
Non-treated	188	1.37
2 Treated	156	1.14
Non-treated	202	1.47
3 Treated	148	1.08
Non-treated	167	1.21
4 Treated	187	1.35
Non-treated	140	1.0
5 Treated	167	1.21
Non-treated	164	1.19
6 Treated	238	1.74
Non-treated	202	1.48
Ave. 30 treated heifers	181	1.32
Ave. 30 non-treated heifers	177	1.29

Experiment II

The second experiment conducted during the winter of 1954-55 was similar to the first experiment completed during the winter of 1953-54. Seventy head of Hereford steer calves purchased by the Department of Animal Husbandry of Kansas State College in October, 1954, from the Lonker Ranch in Barber County, Kansas, were used in this test. These calves were typical of weaned calves that move from the Southwest short grass area

to farms and ranches in Kansas, particularly central and eastern Kansas as replacement calves for the deferred fed steer program.

These steers were hip hot-iron branded and lotted into seven lots, ten head to each lot, on the basis of weight and grade. The winter feeding trials extended from November 16, 1954 to April 5, 1955 (140 days), with the following rations:

Lot 9 - Atlas Silage, CSM 1#, 4# ground Milo, trace minerals.

Lot 10 - Atlas Silage, CSM 1#, 4# ground Milo, control.

Lot 11 - Atlas Silage, CSM 1#, 4# ground Milo, Hormone.

Lot 12 - Atlas Silage, CSM 1#, 4# ground Milo, Hormone.

Lot 13 - Atlas Silage, CSM 1#, 4# ground Milo, Torula utilis yeast.

Lot 14 - Atlas Silage, CSM 1#, 4# ground Milo, Saccharomyces corevisioe.

Lot 15 - Atlas Silage, CSM 1#, 4# ground Milo, Control.

Fecal samples were collected from lots 9 and 10 on an individual basis and from lots, 11, 12, 13, 14, and 15 on a composite basis of the treated and non-treated steers in each lot. Pre-treatment fecal samples were collected on December 3, 1954. Thirty-five steers, five in each lot, were treated with two boluses containing a total of 60 grams of phenothiazine on December 13, 1954. Fecal samples were collected following treatment on January 13, 1955, February 11, 1955, and March 7, 1955.

Results of Experiment II

The EPG count of fecal samples collected from the steers prior to treatment and following treatment is summarized in Table 5.

Table 5. Average stomach worm eggs per gram of the treated compared to the non-treated in lots 9 through 15, inclusive. Steer calves 1954-55.

Lot No.	Pre-treatment December 3, 1954	January 13, 1955	February 11, 1955	March 7 1955
9 Treated	26.8	6.8	17.2	34
Non-treated	12.8	8	3.2	28
10 Treated	7.6	5.2	5.6	16
Non-treated	14	8.4	22.4	30
11 Treated	12	24	30	14
Non-treated	20	2	16	2
12 Treated	18	4	6	6
Non-treated	10	22	24	6
13 Treated	64	4	20	0
Non-treated	12	14	16	8
14 Treated	14	10	24	2
Non-treated	18	8	20	14
15 Treated	6	16	6	6
Non-treated	6	2	6	6
Average				
Treated	21.2	10.0	15.5	11
Non-treated	13.25	9.2	15.4	13.4

The EPG counts for the pre-treatment collection and the three collections taken at monthly intervals following treatment are given in Tables 10, 11, 12, and 13 in the appendix.

The initial and final weights of the steers and the total gain per steer during the 140 day dry lot wintering period from November 16, 1954, to April 5, 1955, is given in appendix Table 14.

A summary of the gains by lots of the treated and non-treated steers is given in Table 6.

Table 6. A summary of the treated and non-treated steers by lot, giving the total gain, average gain per head and the average daily gain per head during the wintering period from November 16, 1954 to April 5, 1955.

Lot No.	Total gain	Average gain per head	Average daily gain per head
9 Treated	1366	273	1.96
Non-treated	1320	264	1.90
10 Treated	1378	275.6	1.98
Non-treated	1307	261.4	1.88
11 Treated	1264	252.8	1.82
Non-treated	1406	281.2	2.02
12 Treated	1409	281.8	2.03
Non-treated	1329	265.8	1.91
13 Treated	1263	252.6	1.81
Non-treated	1318	263.6	1.89
14 Treated	1254	250.8	1.80
Non-treated	1314	262.8	1.90
15 Treated	1290	258	1.85
Non-treated	1281	256.2	1.84
Average gain 35 head treated steers		263.5	1.88
Average gain 35 head non-treated steers		265.0	1.89

The thirty-five treated steers made an average gain of 263.5 pounds or an average daily gain of 1.88 pounds. The thirty-five non-treated steers made an average gain of 265 pounds or an average daily gain of 1.89 pounds.

DISCUSSION

In recent years Kansas stockmen have asked the question, "are cattle parasitized with worms and if so would treatment pay"? The question is asked more often by those who purchase replacement calves originating from the southwest range country. County agents in southeast Kansas have asked the same question regarding worms in calves raised or purchased and grazed intensively on seeded pastures.

The purpose of this experiment was to determine the degree of parasitism of replacement calves purchased from the Southwest and the effect of treatment with phenothiazine on gains.

The first experiment was conducted with heifer calves raised near Snyder, Texas, which is typical of many replacement heifer and steer calves handled on Kansas farms and ranches. The EPG count of the fecal samples prior to treatment in Table 1 showed a moderate degree of parasitism on the basis of an average stomach worm egg count of 156. Roberts, et. al. (9) states that 500 to 700 EPG was considered a border line infestation, and when accompanied by 300 EPG or more of B. radiatus or B. phlebotomus was definitely a dangerous parasitic level.

The EPG count is one means of estimating the degree of parasitism and the method used in these two experiments. Andrews et. al. (1) in studying worm infestations in cattle in Georgia indicates the number of worm eggs per gram is not a dependable aid in ascertaining which animals are suffering from parasitosis.

Tables 2 and 3 show the EPG counts following treatment indicating a significant reduction in EPG was not obtained. There was still the wide variation between heifers in EPG. The range was as great as in the pre-treatment EPG counts and varying from as little as 2 to 400.

Herlich and Porter (6) were able to reduce the average EPG count from 359 to 36 at the conclusion of a worming experiment using 60 grams of phenothiazine for treatment. The treated gained an average of 91 pounds compared to 81 pounds for the controls. The calves were grazed on seeded pastures which is a different method of feeding than used in this experiment.

Although the 30 treated heifers gained 4.0 pounds more than the thirty non-treated heifers, their was not a consistent increased gain in all six lots. The treated heifers in lot 1 gained just one pound more than the non-treated heifers. The treated heifers in lot 2 gained 46 pounds less than the non-treated heifers, and likewise in lot 3 the treated heifers gained 19 pounds less. In lots 4, 5, and 6 the treated heifers gained 47, 3, and 36 pounds more respectively than the non-treated heifers.

Likewise individual gains of these heifers was extremely variable as shown in appendix Table 9.

The difference in gains between the treated and non-treated heifers was not significant as exemplified by the non-significant t value. The calculated t value was .36 and the value required to be significant at the .05 level with 58 degrees of freedom

is 2.0.

The thirty treated heifers averaged a total gain of 181 pounds compared to 177 pounds for the thirty non-treated heifers in the 137 day wintering period. The average daily gain for the treated was 1.32 pounds per head and 1.29 pounds per head for the non-treated heifers.

The seventy head of steer calves were on a higher level of wintering than the heifers and consequently made greater winter gain. These steer calves were raised on the Lonker ranch in Barber County, Kansas. The pre-treatment fecal samples revealed a low level of parasitism as shown in Table 5. The highest EPG was 64 in the thirty-five head of calves designated for treatment. The average EPG count in the pre-treatment samples on December 3, 1954, was 21.2 for the steers designated for treatment and 13.25 for the steers designated non-treated. On March 7, 1955, when the last fecal collections were made the treated steers had an average EPG count of 11 and the non-treated steers an average EPG of 13.4.

The level and range of parasitism in the steers in Experiment II was much lower and narrower than in the heifers in Experiment I.

The thirty-five treated steers gained an average of 263.5 pounds in the 140 day dry lot wintering period while the 35 non-treated steers gained an average of 265 pounds. The average daily gain was 1.88 pounds for the treated steers and 1.89 pounds for the non-treated steers.

Calves grazing bluegrass and white clover in Ohio according to Harwood (5) gained 20½ pounds more than the untreated in 1943, and 15.3 pounds more in 1944. The treated calves were provided with medicated salt and the untreated plain salt for 113 days on pasture. The 600 pound calves consumed four to five grams of phenothiazine daily in the medicated salt. This was sufficient to achieve direct anthelmetic effect and reduced egg count during the experiment. Whereas most of the work cited has been the effect of treatment of cattle grazing pastures, this experiment was conducted with calves wintered in the dry lot.

SUMMARY

The EPG counts of the fecal samples of the 60 heifer calves and 70 steer calves in these experiments were probably not high enough to be pathogenic.

The thirty heifers in Experiment I treated with 60 grams of phenothiazine powder in bolus form gained 4.0 pounds more than the 30 non-treated heifers in the 137 day wintering period. This increased gain was not statistically significant.

In Experiment II, thirty-five steers treated with 60 grams of phenothiazine made an average daily gain of 1.88 pounds. The 35 non-treated steers made an average daily gain of 1.89 pounds. This daily gain was during the 140 day wintering period in the dry lot.

The data obtained under the conditions these two experiments were conducted would indicate that treatment of heifer and steer

calves with phenothiazine powder in bolus form would not materially lower the EPG count nor increase the gain in the dry lot wintering period.

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APPENDIX

Table 7. EPG count of fecal samples collected January 14, 1954, at time of treatment.

Sample Number	Stomach worm	Hookworm	Tapeworms	E. bovis coccidia	Nematodirus
1*	24			Many	
2*	36	2		Some	
17*	294	2		Few	
20*	20			Few	
22*	104		Few	Many	8
23*	132		Many	Few	
25*	88			Few	
27*	282			Few	
29		lab accident			
30*	82			Few	
32	30		Few	Few	
36*	48			Few	6
37	128				
38	20			Few	2
43	88			Few	
47	28		Few		
48*	226	8	Many		10
51*	150	6	Some	Some	8
52*	38		Many	Many	
53	614	6		Few	
58*	280			Many	
60*	50				
61*	108				
62*	32			Some	
63	16			Few	
65*	80				
67	28			Few	
79	292			Many	10
80	70				
81	160			Few	
85	22			Few	
88*	2	2		Some	2
90*	960			Many	
92*	180			Very few	
93*	18	2		Few	
94		dehydrated			
95*	32			Few	
96	240	10		Few	
98	234	6		Few	6
99	74				4

*Animals treated

Table 8. EPG count of fecal samples collected February 11, 1954, following treatment.

Sample Number	Stomach worm	E. bovis coccidia	Tapeworm
1*	2		
2*	46	38	
4	4	2	96
8*			90
12*	4		
14	40	4	
16	10		56
18	136		
20*	45		
31	22		
35	64		
39	24	6	
40	360	10	
41*			
45	2		12
53	235		
64*	20		
77*	32		2

*Animals treated

Table 9. Initial and final weights and the total gain of heifers treated and non-treated during wintering period December 17, 1953 to May 3, 1954, 137 days.

Animal Number	Initial weight	Final weight	Total gain
	Lot No. 1 Treated		
12	235	385	150
8	282	487	205
86	287	540	253
1	325	470	145
41	327	520	193
	Lot No. 1 Non-treated		
4	260	422	162
45	320	490	170
39	320	560	240
40	327	532	205
16	260	427	167
	Lot No. 2 Treated		
20	247	385	138
17	280	430	150
64	290	392	102
2	320	527	207
77	327	512	185
	Lot No. 2 Non-treated		
14	257	475	218
13	265	450	185
53	320	502	182
35	320	582	262
31	330	495	165
	Lot No. 3 Treated		
30	375	580	205
36	387	500	113
46	347	505	158
58	357	525	168
65	335	435	100

Table 9 (cont.)

Animal Number	Initial weight	Final weight	Total gain
	Lot No. 3 Non-treated		
38	347	500	153
80	357	530	173
83	387	585	198
94	375	535	160
100	335	485	150
	Lot No. 4 Treated		
23	380	550	170
48	352	515	163
51	332	515	183
62	350	585	235
88	377	565	188
	Lot No. 4 Non-treated		
29	370	515	145
43	340	500	160
67	397	470	73
99	340	485	145
98	365	545	180
	Lot No. 5 Treated		
22	355	565	210
60	332	510	178
92	350	510	160
93	382	550	168
95	377	495	118
	Lot No. 5 Non-treated		
37	337	460	123
47	362	545	183
63	342	455	113
66	372	570	198
81	395	580	185

Table 9 (concl.)

Animal Number	Initial weight	Final weight	Total gain
		Lot No. 6 Treated	
25	335	565	230
61	347	552	205
90	355	640	285
27	375	640	265
52	385	592	207
		Lot No. 6 Non-treated	
96	337	575	238
97	342	507	165
32	362	565	203
85	372	505	133
79	390	665	275

Table 10. EPG count of pre-treatment fecal samples collected December 3, 1954.

Sample Number	Stomach worms	Tapeworms	E. bovis coccidia
	Lot 9 - Individual samples		
16*	24	476	198
27	44		72
45	8		102
48	12		84
56			32
63*	20		56
76*	62	372	240
85*	6	238	176
R-7			
R-6*	22		22
	Lot 10 - Individual samples		
18*	14	544	158
23*	2		604
64*	16	2	20
69		84	14
74	44	18	62
77	4		52
82*			10
95	6	50	90
R-11*	10		286
R-8	16		2
	Lots 11 through 15 inclusive, composite samples		
Lot 11	20	130	28
11*	12	28	16
12	10		56
12*	18	174	38
13	12	4	58
13*	64		52
14	18	78	84
14*	14	86	198
15	6	100	194
15*	6	46	108

*Animals treated

Table 11. EPG count of fecal samples collected January 13, 1955.

Sample Number	Stomach worms	Tapeworms	E. bovis coccidia
	Lot 9 - Individual samples		
16*	16	1438	3
27	14	88	2
45	6	2	5
48	16	88	6
56	4		2
63*	10		2
76*	4		3
85*		216	1
R-7		66	1
R-6*	4	20	1
	Lot 10 - Individual samples		
18*	6	1468	
23*	2		
64*	12	78	
69	2	436	1
74	26	4	
77	4		
82*	2		
95	10	2	
R-8	16		1
	Lots 11 through 15 inclusive, composite samples		
Lot 11	2	38	
11*	24	722	1
12	22		2
12*	4	138	2
13	14	60	1
13*	4	2	2
14	8	174	
14*	10	32	
15	2	32	2
15*	16	166	1

*Animals treated.

Table 12. EPG count of fecal samples collected February 11, 1955.

Sample Number	Stomach worms	Tapeworms	E. bovis coccidia
	Lot 9 - Individual samples		
16*	10	282	
27	2		2
45	4		4
48	8	100	
46	2		
63*	20		2
76*	22	2	
85*	14	240	3
R-6*	10	40	1
	Lot 10 - Individual samples		
18*	2	1042	
23*	6		
64*	10	62	
69	6	434	
74	76		3
77	4		1
82*	4		
95	20		4
R-11*	6		2
R-8	24	22	1
	Lots 11 through 15 inclusive, composite samples		
Lot 11	16	810	3
11*	30	146	2
12	24		
12*	6	134	2
13	16	82	
13*	20	42	2
14	20	16	
14*	24	6	
15	6	84	
15*	6	136	

*Animals treated.

Table 13. EPG count of fecal samples collected March 7, 1955.

Sample Number	Stomach worms	Tapeworms	E. bovis coccidia
	Lot 9 - Individual samples		
16*	10		4
27	22		3
45			
48	6	light	3
56			1
63*	20		2
76*	2		
85*	2		2
R-6*			
	Lot 10 - Individual samples		
18*	4		6
23*	4		
64*	8	light	1
69	2		1
74		light	1
77			1
82*			3
95	10	light	2
R-8	18		3
R-11*			1
	Lots 11 through 15 inclusive, composite samples		
Lot 11	2		3
11*	14		
12	6		3
12*	6	light	2
13	8	medium	2
13*			1
14	14	light	1
14*	2	light	2
15	6	light	3
15*	6	medium	4

*Animals treated.

Table 14. Initial and final weights and the total gain of steers in lots 9 through 15, inclusive, during the wintering period November 17, 1954 to April 5, 1955.

Animal Number	Initial weight	Final weight	Total gain
	Lot 9 Treated		
63	480	775	295
85	455	762	307
16	425	655	230
76	385	632	247
R-6	540	827	287
	Lot 9 Non-treated		
48	510	760	250
56	477	772	295
27	450	720	270
45	420	680	260
R-7	415	660	245
	Lot 10 Treated		
82	505	822	317
64	475	770	295
23	445	707	262
18	420	652	232
R-11	430	702	272
	Lot 10 Non-treated		
95	485	735	250
69	455	717	262
74	425	710	285
77	385	635	250
R-3	515	775	260
	Lot 11 Treated		
49	485	780	295
52	455	712	257
58	425	745	320
38	390	530	140
R-3	505	757	252

Table 14. (cont.)

Animal Number	Initial weight	Final weight	Total gain
	Lot 11 Non-treated		
62	500	797	297
41	475	792	317
93	445	715	270
8	420	710	290
R-5	455	687	232
	Lot 12 Treated		
60	495	785	290
55	467	782	315
4	440	710	270
81	410	697	287
R-4	465	712	247
	Lot 12 Non-treated		
90	485	775	290
53	460	662	202
66	430	680	250
26	395	665	270
R-10	505	822	317
	Lot 13 Treated		
23	520	780	260
57	480	807	327
25	450	672	222
12	450	697	247
R-14	355	562	207
	Lot 13 Non-treated		
21	480	782	302
86	425	722	297
87	420	672	252
59	375	582	207
R-9	585	845	260

Table 14 (concl.)

Animal Number	Initial weight	Final weight	Total gain
	Lot 14 Treated		
70	485	712	227
22	460	760	300
61	435	680	245
94	400	672	272
R-12	500	710	210
	Lot 14 Non-treated		
88	490	760	270
32	465	692	227
46	440	712	272
42	410	685	275
R-2	475	745	270
	Lot 15 Treated		
2	487	757	270
72	465	750	285
44	435	697	262
43	402	650	248
R-00	490	715	225
	Lot 15 Non-treated		
78	490	735	245
91	465	752	287
54	440	710	270
30	405	617	212
R-1	485	752	267

THE PERFORMANCE OF PHENOTHIAZINE TREATED CATTLE

by

WENDELL AUSTIN MOYER

B. S., Kansas State College
of Agriculture and Applied Science, 1941

AN ABSTRACT OF A THESIS

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It is generally recognized that cattle are parasitized by worms, which extract a loss in gains and wasted feed, but seldom cause cattle deaths. A number of events may be leading to a greater infestation of cattle by worms. The more extensive use of pond water for cattle on range and farm pastures would tend to make environmental conditions more favorable for worms. Greater movement of cattle from one area to another with faster transportation would tend to spread worm eggs over a wider range. The more intensive use of seeded pastures would favor worm development, especially in the heavy rainfall areas. And, last but not least, the continued expansion of cattle numbers would tend to increase the parasitic problem on many farms and ranches.

A large percent of replacement calves and yearlings purchased by Kansas Stockmen for replacements are purchased in the Southwest plains areas of Texas, Colorado, Oklahoma, New Mexico, and southwest Kansas. The replacement cattle are handled essentially on one of the following beef production programs: (1) deferred fed steers or heifers; (2) winter and grazing; and (3) grazing alone producing feeders or grass fat steers.

Stockmen have often asked the question "are replacement cattle purchased in the west and southwest parasitized with worms and if so would treatment pay?"

Many of the experiments conducted by the Animal Husbandry Department of Kansas State College in past years have been with weanling steer and heifer calves purchased from ranches in the west and southwest plains area. These experimental cattle

have been typical of cattle used by farmers and ranchers for commercial beef production throughout Kansas. Therefore, these cattle appeared to be ideal experimental subjects with which to study the economic importance of stomach worms in Kansas cattle.

Phenothiazine was used in this study as an anthelmintic because it is generally believed to be effective in controlling worms in cattle and sheep. In addition it is an anthelmintic which is easily administered and has practically no ill effects on the animals. This experiment was designed to study the degree of parasitism, on the basis of fecal collections and egg per gram counts, and the effect of treatment with phenothiazine on gains.

Two experiments were conducted for this study. The first experiment was conducted during the winter of 1953-54 with Hereford heifer calves raised near Snyder, Texas, purchased by the Animal Husbandry Department of Kansas State College. The heifers were uniformly divided on the basis of weight and grade into six lots, ten head to the lot. The heifers were weighed individually at the beginning of the test on December 17, 1953, and at the conclusion of the wintering period on May 3, 1954.

To determine the degree of parasitism, composite and individual fecal samples were collected prior to treatment. On January 14, 1954, five heifers in each lot, thirty head in all were treated with 60 grams of phenothiazine in the form of two boluses. Fecal samples were collected following treatment. Lots 1 and 3 were collected on a composite basis; treated and non-treated, while individual fecal collections were made from

lot 4. These collections were made on March 9 and April 9, 1954.

Experiment II was conducted during the winter of 1954-55 similar to the first experiment. Seventy head of Hereford steer calves purchased by the Animal Husbandry Department of Kansas State College in October 1954, from the Lonker Ranch in Barber, County, Kansas, were used in this test. The steers were divided into seven lots, ten head per lot, on the basis of weight and grade. The steers were weighed individually at the beginning of the test on November 16, 1954, and at the conclusion of the wintering period on April 5, 1955.

Fecal samples were collected from lots 9 and 10 on an individual basis and from lots 11, 12, 13, 14, and 15 on a composite basis of the treated and non-treated steers in each lot. Pre-treatment fecal samples were collected on December 3, 1954. Thirty-five steers, five in each lot, were treated with two boluses containing a total of 60 grams of phenothiazine on December 13, 1954. Fecal samples were collected following treatment on January 13, 1955, February 11, 1955, and March 7, 1955.

The heifers in Experiment I showed an average EPG count of 156 prior to treatment. The EPG counts following treatment showed little if any reductions and the same variation as in the pre-treatment collections. The thirty treated heifers made an average daily gain of 1.32 pounds per head, while the thirty non-treated heifers made an average daily gain of 1.29 pounds

per head. The treated heifers gained 4.0 pounds more than the non-treated heifers in the 137 day dry lot wintering period.

The average EPG of the 35 treated steers was 21.2 (prior to treatment) compared to 13.25 for the non-treated. On March 7, 1955, the 35 treated steers had an average EPG of 11 compared to 13.4 for the non-treated. The 35 treated steers made an average gain of 263.5 pounds or an average daily gain of 1.88 pounds. The 35 non-treated steers made an average gain of 265 pounds or an average daily gain of 1.29 pounds.

The EPG counts of the fecal samples of the 60 heifer calves and 70 steer calves in these experiments were probably not high enough to be pathogenic. The 4 pounds per head additional winter gain made by the treated heifers was not statistically significant. The treated steers gained 1.5 pounds less in the wintering period than the non-treated steers.

The data obtained under the conditions these two experiments were conducted would indicate that treatment of heifer and steer calves with phenothiazine powder in bolus form would not materially lower the EPG count nor increase the gain in the dry lot wintering period.