The Significance of Bovine Coccidiosis as a Disease in the United States

Paul R. Fitzgerald, *Ph.D.*
College of Veterinary Medicine
University of Illinois
Urbana, Illinois 61801

In spite of the fact that reports have been published which state the importance of bovine coccidiosis (4,6) the status of the disease has been uncertain. Niilo (5) contributed a significant report on the importance of the disease in Canada because of the availability of records on incidence of the disease as well as the cooperation of practicing veterinarians.

In the United States bovine coccidiosis is not a reportable disease and therefore no official records are kept of its incidence. Only a few cases reach the state diagnostic laboratories. Because of this, unreliable information on incidence comes from diagnostic laboratories. This does not reflect upon the abilities of the laboratories to diagnose accurately but rather upon a system which is inappropriately used for securing incidence of disease information.

Since only hearsay evidence was available it was decided to initiate a survey among veterinarians and cattle producers to learn more of their experiences with this disease.* The data presented is the result of a survey conducted during 1973 and 1974.

Materials and Methods

Study Sites in the United States:

Questionnaires were prepared to be used in connection with personal interviews with veterinarians, cow-calf producers or ranchers, and feedlot and dairy producers. Whenever possible, taped interviews were recorded. Most interviews were conducted on a face-to-face basis but a few were by telephone. Initial contacts were supplied from letter contacts, state diagnostic laboratories, extension personnel, veterinary clinics, and friends.

The areas for study were selected from states with the most beef and dairy cattle.

Results

Personal interviews were conducted with 165 veterinarians in 28 states, 12 dairy producers milking about 2,500 cows, 33 cow-calf producers involving about 25,000 cows, and operators of 14 feedlots involving more than one million cattle.

The initial interviews showed that the most useful information came from the veterinarians. Producers invariably referred to the veterinarian who either cared for or advised on the care of their animals. Greater effort was therefore directed towards getting information from the veterinarian for the remainder of the study.

Results for each significant question were summarized and tabulated for each of the eight sampling tours. In some instances answers were non-specific and an arbitrary answer had to be substituted. The interviews with cow-calf and feedlot producers and with dairy producers, from different sites, are combined because of the fewer number of interviews and because of duplication of information. Answers were recorded in as nearly an unbiased a manner as was possible.

For Information and Reference:

The following, from the USDA mid-year cattle inventory report July 1, 1973 (7) is a summary of the estimated numbers and classes of cattle in the United States:

Cows and Heifers that have calved		53,788,000
Beef Cows	42,363,000	
Dairy Cows	11,425,000	
Heifers 500 lbs. and over		18,304,000
for beef cow replacements	7,173,000	
for milk cow replacements	3,904,000	
other heifers	7,227,000	
Steers 500 lbs and over		17,669,000
Bulls 500 lbs and over		2,632,000
Heifers, steers, and bulls under 500 lbs.		38,262,000
Calves born		50,000,000
TOTAL		130,655,000

Of these, 76,867,000 would be most susceptible to coccidiosis. A few cows and heifers could be susceptible but for the most part would be resistant. Research has shown that infections with *Eimeria* are so common that all of the approximately 77 million young cattle will be infected sometime during the first year of life (2,4,5,6).

Figure 1 shows the approximate number of cattle by states and the sampling sites visited during the study. Table 1 indicates the states in which interviews were conducted along the routes shown.

Incidence Rate

Coccidiosis is less a problem in some areas than in others. Veterinarians in all areas were aware of the disease but there was no agreement as to what stimulated outbreaks. Most believed that "stress" was a factor. Of the 165 veterinarians interviewed only three indicated they did not see coccidiosis in their practices. About 36% of those replying saw more than 50 cases per year; some saw hundreds, and

*The support of Eli Lilly and Company made this study possible and is gratefully acknowledged.

Figure 1. Map of the United States showing approximate number (in millions) of cattle by states. Survey sampling sites are superimposed and are shown by small connected circles and a number.

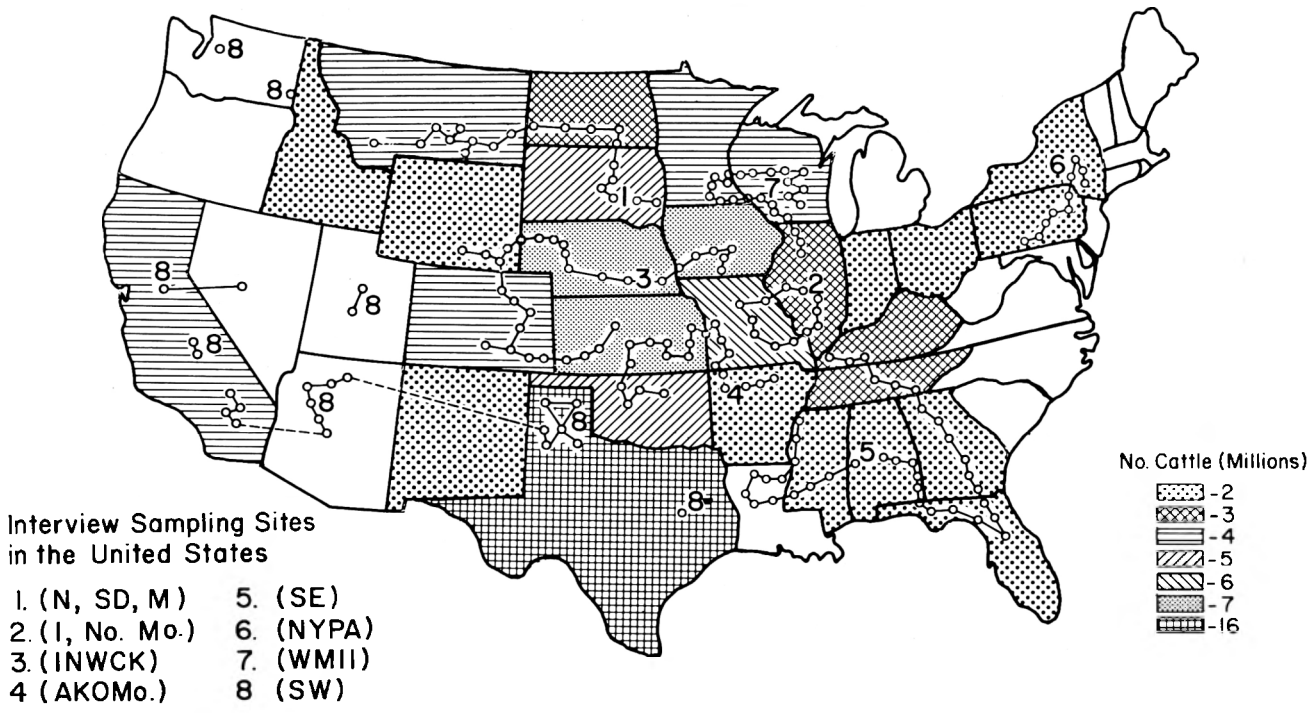


Table 1

Sites Samples

1. North Dakota, South Dakota, Montana	(N, SD, M)
2. Illinois, Northern Missouri	(IL, No. Mo)
3. Iowa, Nebraska, Wyoming, Colorado, Kansas	(INWCK)
4. Arkansas, Kansas, Oklahoma, Missouri	(AKOMo)
5. Mississippi, Louisiana, Alabama, Florida, Georgia, Tennessee, Kentucky	(SE)
6. New York and Pennsylvania	(NY, PA)
7. Wisconsin, Minnesota, Illinois	(WMIL)
8. Texas, Arizona, California, Utah, Nevada	(SW)

others thousands of cases, with mortality rates as high as 24%. None were able to state exactly how many cases they treated.

Twenty-eight states have 115 million of the 130 million cattle (88%) in the United States (Figure 1). The states between the Mississippi River and the Rocky Mountains produce and feed the largest number and have the greatest problem with coccidiosis. Texas, Kansas, and Colorado have large numbers of cattle infected in feedlots, and Nebraska, North and South Dakota, Montana, and Wyoming have infections on the range. In between are all kinds of outbreaks from small to large operations.

To arrive at an estimate of the number of animals affected annually, two kinds of information were used: (1) veterinarian-reported treated cases, and (2) veterinarian estimates of numbers of animals treated by owners. It is a common practice for producers to consult the veterinarian for diagnosis and treatment of first infections. The producer soon learns to recognize signs of the disease and thereafter treats his own animals. Sometimes he purchases medication from the practitioner or he goes to a supply store to purchase required drugs. (This usually depends upon which source is cheapest). Veterinarians estimate that two to four times as many cases are treated by producers as by veterinarians. This seems reliable because in many instances they dispense the drugs to the clients.

About 25% of the veterinarians were asked to estimate how many animals they treated annually for all diseases. Their answers were highly variable but a conservative average was about 5,000 or 6,000. The AVMA professional activity summary for January 1972 (1) lists 1,569 large animal and 8,157 mixed practice veterinarians. If one calculates that coccidiosis is, on the average, the number five problem in the practice (Table 3) and breaks the cases down in the following arbitrary way (No. 1 = 2,560*, 2 = 1280, 3 = 640, 4 = 320, 5 = 160, 6 = 80, 7 = 40, 8 = 20, 9 = 10, 10 = 5) then the average large animal and mixed practice veterinarian would treat about 160 cases of coccidiosis per year. Assuming the mixed practices were one-half large animals (cattle), veterinarians could then be calculated to treat more than 903,000 cases of coccidiosis annually. If we use their estimate that two to four times the number of cases they treat are treated by producers, (growers, owners, feeders, etc.) and we use an average of three, then an additional 2,710,000 animals are treated, making a total

of approximately 3,616,000 cattle treated for coccisiosis annually. This would be nearly 5% of the 77,000,000 young cattle most susceptible to coccidiosis. It is likely that many others have varying degrees of infection and go untreated.

There was no agreement as to whether the disease was increasing or decreasing. In some areas comments were "it is not as bad as it was five or ten years ago" or "we have had epidemic proportion outbreaks with thousands of cases this year." However, with more and greater concentration of animals it appears that there may be more coccidiosis now than previously. However, this is conjecture because there is no data from the past with which the present can be compared.

Age Group Most Frequently Affected

Coccidiosis was seen most frequently in calves six to nine months old under feedlot conditions. Unusual management problems seem to influence outbreaks. For example, in the sand hills of Nebraska cattle are watered on the range from windmill driven pumps. In June tanks often overflow and create mud holes from which calves drink. Inadvertently, they pick up infections which cause outbreaks about the same time each year.

Variation with Season

About 38% of the veterinarians replied that outbreaks were not seasonal. However, this varied with the area and the kinds of animals produced. Summer months, generally, were more or less free of coccidiosis. Of those reporting a seasonal occurrence, about 46% reported that they saw most cases in the fall. Twenty-three percent indicated they saw more cases in winter and spring. Some indicated that wet weather was more important than the season, but this varied with the area and management practices. Many indicated it was sporadic but was important when it occurred.

Medication Most Often Used

Sulfa drugs are the most frequently used medication for both prophylaxis and therapy. Some compounds include astrigents, charcoal, etc., and are made up as a "coccidolus." In some areas nitrofurazone was the drug of choice, although the drug does not have good coccidiostatic properties. Some claim the clinical aspects are relieved by its administration. In a few instances, products such as sulfur, copper sulfate, arsenic or other completely unproven compounds are used. Amprolium,* was used by a few veterinarians and some feedlot and cow-calf producers.

Animals treated on an individual basis were usually treated orally by dose syringe, bolus, or capsule. When outbreaks require medication on a herd basis the preferred carrier is water. When sulfamethazine is used, it is usually given as a bolus, but some sprinkle it on feed.

Some veterinarians believe coccidiosis occurs as frequently as respiratory disease but is of less importance. At least one veterinarian believed that the usual clinical signs of bloody diarrhea in the feedlot should be ignored until evidence of severe infection appears. This philosophy was not shared by others.

Rate of Recovery from Coccidiosis

Forty-two percent of the veterinarians indicated recovery was complete in three to four days, however, many qualified this with a statement that recovery depends upon how soon animals are treated after clinical signs appear. Thirty-four percent indicated there was slow recovery. Fourteen percent stated that cattle that survived severe infections never catch up with their peers except after an extra 30 to 60 days feeding period. Nine percent stated that recovery depends upon the severity of the infection. Most practitioners stated that cattle with central nervous system involvement usually die.

Percentage of Animals That Die

Two-thirds of the veterinarians believed that less than 5% of affected animals die. Twenty-one percent stated that more than 20% die. Most of the latter would be those that develop central nervous system signs. Nearly half of those interviewed in the southeastern states believe more than 20% die. This is inconsistent with the other areas, but it may be because animals become infected in pastures and owners do not check them often enough to get animals treated early in the infection.

If we assume that about 5% of the young cattle are treated for coccidiosis annually, and we use the veterinarians' estimates of those that die, we can calculate deaths of 38,500 (1%) to 770,000 (20%) per year. Only a few veterinarians are able to follow up the cattle they treat and therefore cannot be sure of how or whether cattle recover following treatment.

Coccidia Causing Outbreaks

Few of the producers in dairy, cow-calf or feedlot operations could name the coccidia that caused outbreaks. About 50% of the veterinarians either knew immediately or could identify from a book the organism responsible for the outbreaks they saw. Most of them identified *Eimeria zuernii* as the pathogen associated with outbreaks. Some prac-

Table 2

Species Causing Outbreaks

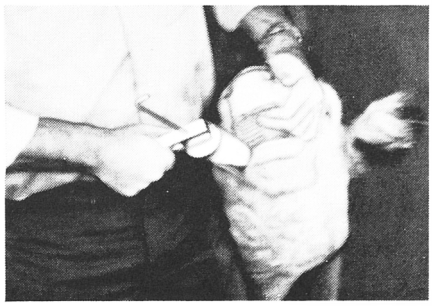
Site	E. zuernii	E. bovis	Other Species	Don't know	Total
1 (N.SD, M.)	12			84	16
2 (I, NO.MO)	7		1	7	15
3 (INWCK)	16			5	21
4 (AKOMo)	8	3	1	9	21
5 (SE)	11	1		25	37
6 (NY, PA)	1			10	11
7 (WMIL)	4			10	14
8 (SW)	12			5	17
TOTALS	71	4	2	75	152

*Amprolium - Merck and Company, Rahway, N.J.

Try the no-setback system

The OMNIZOLE® (thiabendazole) Cattle Wormer No-Setback System: OMNIZOLE in new paste form, in a disposable, plastic cartridge and easy-to-use MEDIGUN®. It delivers premeasured, positive doses. Each cartridge contains enough for ten 500-lb animals.

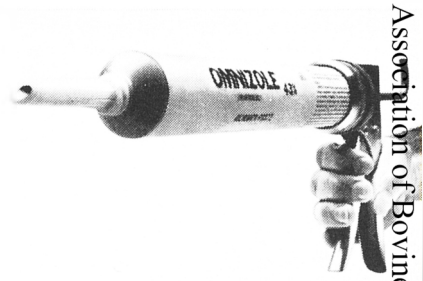
OMNIZOLE stays put, can't be spit or drooled out. No mixing or waste, no refrigeration necessary. It's ideal for range, pasture, and dairy animals because it combines safety, convenience, ease-of-use, and—most important—improved growth and gains on available feed or forage, thanks to no-setback worming.



OMNIZOLE®
(thiabendazole)

PROFESSIONAL VETERINARY PRODUCTS, MERCK CHEMICAL DIVISION, RAHWAY, N. J. 07065

OMNIZOLE
(thiabendazole)



INDICATIONS For the control of gastrointestinal roundworms in cattle.*

For a satisfactory diagnosis, a microscopic fecal examination should be performed prior to worming.

DOSAGE OMNIZOLE Wormer Paste is given orally to cattle. The dosage is proportional to body weight and also depends on the severity of infection. The routine dose of thiabendazole for *Trichostrongylus* sp, *Haemonchus* sp, *Nematodirus* sp, *Ostertagia* sp, and *Oesophagostomum radiatum* is 3 g per 100 lb body weight. For *Cooperia* sp, or severe infections with the other species, give 5 g per 100 lb. For most effective results, severely parasitized animals or those constantly exposed to helminth infection should be re-treated every two to three weeks.

Each full depression (3 "clicks") of the dosing-gun trigger delivers one dose containing 7.5 g thiabendazole. Administer OMNIZOLE Wormer Paste as follows:

For routine worming, give one dose for each 250 lb body weight.

For *Cooperia* sp, or severe infections with the other species, give one dose for each 150 lb.

WARNING Milk taken from treated animals within 96 hours (8 milkings) after the latest treatment must not be used for food. Do not treat cattle within 3 days of slaughter.

*Genera *Trichostrongylus* sp, *Haemonchus* sp, *Nematodirus* sp, *Ostertagia* sp, *Oesophagostomum radiatum*, and *Cooperia* species

OMNIZOLE (thiabendazole) and MEDIGUN (medicinal applicator) are registered trademarks of Merck & Co., Inc.

MERCK

PROFESSIONAL VETERINARY PRODUCTS
MERCK CHEMICAL DIVISION • RAHWAY N J 07065

VETERINARY

titioners pointed out that they saw other species of coccidia and assumed them to be pathogenic. These were rarely present in large numbers or associated with clinical outbreaks in the herds they treated. Attitudes expressed by some veterinarians suggested a significant number of missed diagnoses both in animals with coccidiosis and without coccidiosis. Most of those who did not know the species of coccidia stated that they sent fecal specimens to diagnostic laboratories for identification and they treated on clinical signs alone. Many diagnostic laboratories failed to identify two species and simply stated "coccidia" in their diagnostic reports.

Importance of Coccidiosis as a Disease in Area

Most veterinarins were asked to state whether they considered coccidiosis to be an important disease in their area. Fifty-six percent stated it was "important" while the others considered it a "minor" problem. About one-third of the practitioners were asked to rank coccidiosis on a one to ten scale with number one representing the most important disease. Fifty-nine percent ranked it among the five most important diseases they treat. About 33% ranked it in second or third position immediately behind respiratory disease or along with it.

Table 3

Consider Coccidiosis Important Disease in Area

				Significance of Scale								
Site	Yes	No	Total	1*	2	3	4	5	6	7	8	9	10
1 (N.SD, M.)	12	5	17		2	5	2	1		1	2	1	
2 (I, No.Mo)	9	7	16			1		1					1
3 (INWCK)	20	3	23		3	1	1	2	1				
4 (AKOMo	13	8	21			3	1	3		2	4		2
5 (SE)	12	24	36						1				
6 (NY, PA)	2	9	11							2	1		
7 (WMIL)	7	7	14										
8 (SW)	12	5	17		1	1		2		2		1	
TOTALS	87	68	155		6	11	4	9	2	7	7	2	3

*Number 1 = most important

Table 4

Important Enough to Justify Prophylaxis

Site	Yes	No	Cost	Other	Total
1 (N.SD, Mo)	11	1	1	1	14
2 (I, No. Mo)	8	8			16
3 (INWCK)	20	0	5	1	27
4 (AKOMo)	13	7		1	21
5 (SE)	19	14	2	2	37
6 (NY, PA)	2	8	1		11
7 (WMIL)	7	7			14
8 (SW)	11	5	6	1	23
TOTALS	91	51	15	6	163

Need and Use for a Prophylactic Compound

Table 4 shows that 56% of those replying believe there is a need for a prophylactic treatment. Thirteen percent specifically pointed out that cost, effectiveness, availability, or other factors would determine use. There were of greatest concern among the feedlot consulting veterinarians. Thirty-one percent of the practitioners said they could effectively handle treatment of the disease with presently available drugs.

Interviews with Producers

The information obtained from producers coincides closely with the data reported above for veterinarians.

Feedlot Producers

Fifty percent of the feedlots interviewed handled 5,000 to 50,000 cattle per year over a feeding period of at least 120 days. Most feeders preferred to start 450 to 700 pound cattle. Sources of feeders are variable but two-thirds of the feeders were transported 500 or more miles to the feeding site. Sixty-six percent of the feedlots indicated they fed some kind of medication in the feed. Additives were usually vitamins or mineral supplements but some added antibiotics for specific purposes such as treatment of shipping fever.

Eleven of 19 replies (multiple answers) from feeders indicated that a veterinarian prescribes treatment but usually a cowboy-rider or manager does the treating. About 42% indicated that affected cattle recover completely while 21% said they never catch up. Thirteen of the 14 feeders stated that one or more cattle died from coccidiosis during each feeding period. About 50% indicated that affected feeders loose considerable weight, the amount depending upon the severity of the infection and individual response to treatment. They are often set back 30 to 60 days in the feeding program.

Cow-Calf Producers

Twenty-five of 36 replies by producers indicated that their cattle were held in confined pastures of approximately 300 acres. About 27% were held on the open range. The size of the producer's operation varied from less than 100 to more than 1,000 cows. About 61% weaned calves at about seven months.

Coccidiosis occurred on about 61% of the ranches. Thirty-nine percent stated that coccidiosis had occurred but was not now a problem. Thirty-eight percent indicated there was no seasonal variation, while about 33% indicated they usually had more trouble in the spring. Thirteen of 17 replies stated that usually more than two animals were involved.

A veterinarian was usually (48%) called in to diagnose and prescribe treatment for affected animals. However, about half of those replying diagnosed and treated their own animals and 41% stated that the severity of the infection determined whether animals recovered completely or poorly. Twenty-nine percent stated they recovered completely. Thirteen of 22 believed there is a need for prophylactic treatment for coccidiosis in their operations. Many stated that the biggest problem

would be in developing a system for medicating calves that are still nursing. Cost did not seem to be as important as in the feedlot operation.

Dairy Producers

Coccidiosis in dairy cattle was considered to be a minor problem by nearly all dairy producers. An assessment of the reason for the low incidence in most dairy areas was made by a veterinarian. He believes that present day dairy farmers are more intelligent and far better trained in agri-business than were their predecessors. They are acutely aware of the condition of their animals, including health, milk producer, costs, land values, etc.

Discussion

Coccidiosis, like most diseases, is a sporadic, unpredictable hazard to the cattle industry. Usually it is held to a minimum by natural circumstances, i.e., resistance of animals, unfavorable conditions for its spread, etc., yet it is one of the most widespread of all diseases. The pathogenic species *E. zuernii* appears to be an opportunist attacking only under specific circumstances. When the right combination of events is at hand, outbreaks occur.

It has been shown that coccidia occur in a high percentage of fecal samples (2). These usually are "chronic" infections. However, the presence of coccidia alone does not mean that an outbreak is imminent. Apparently, "stress" must occur before animals develop severe infections. "Acute" coccidiosis may result in an outbreak that was associated with an earlier stress.

This study has shown that coccidiosis is a disease that can occur anywhere, anytime. Some stress conditions with which it is frequently associated are cold and wet weather, poor shelter, poor feeding facilities and abrupt changes in feeding programs. The disease does not appear to be seasonal except that during the summer months the number of outbreaks is reduced in most areas. Outbreaks are unpredictable although in some areas they occur regularly year after year.

The extent of the yearly outbreaks is of much concern. It is conservatively estimated that 5% of the young cattle require treatment for coccidiosis each year. During an average year this is about 3,850,000 animals.

The results of this study suggest that coccidiosis outbreaks are often a result of mismanagement or lack of management. *Eimeria zuernii* is almost always the cause of outbreaks in all parts of the country. At least part of the reason for the seriousness of outbreaks is due to our lack of knowledge about how to deal with this species.

Additional research is needed in several areas. First, research needs to be done using the causative organism. The reason it has not been done before is because no one has been able to produce experimental infections consistently. Secondly, a condition referred to as the "central nervous system" form of coccidiosis occurs and is usually fatal. Essentially no research has been done on the etiology of this condition. Ten thousand cattle in the United States may die annually from this syndrome. Third, specific programs need to be developed to help teach better management skills to producers. Probably the greatest factors causing a decline in the incidence of coccidiosis in dairy operations are intense and better management practices.

Summary

Inquiries, by personal interviews, were conducted with 165 veterinarians, 14 feedlot operators, 33 cow-calf producers and 12 dairy producers throughout the United States to determine the importance of bovine coccidiosis. On the average, the disease was considered the 5th most important. In some areas it is equal in importance to respiratory diseases (No. 1 throughout the country).

Coccidiosis is not consistently prominent in all areas of the country. It occurs most frequently and causes greatest loss in the states west of the Mississippi River. Generally, beef cattle are most frequently and severely affected. Management, or lack of it, plays a part in outbreaks. However, physical location appears to be important in some areas.

Since no records are kept of animals infected with, or treated for, coccidiosis (the same is true for respiratory disease) these empirical observations are based on impressions or statements obtained from veterinarians or producers. Calculations indicated that about 77,000,000 young cattle are susceptible to coccidiosis each year. About 3,850,000 are treated and 80,000 or more die from the disease.

The disease does not appear to be seasonal. However, fewer cases are observed and reported during the summer months than during the remainder of the year. Local exceptional variations occur and outbreaks occurring in feed yards are usually not correlated with disease on the range.

Presently, sulfa drugs are the most widely used medication. Prophylaxis, based on medication, is not now a part of any production program. In specific instances, such as herd outbreaks, prophylactic medication may be used to control the disease. There is need for better prophylaxis and therapeusis.

In practically all outbreaks, where clinical signs and/or central nervous system signs occur, the causative organism is *Eimeria zuernii*. Other coccidia frequently are present in small numbers but are not associated with outbreaks.

Literature Cited

1. AVMA. Professional Activity Summary, AVMA Directory (1972): B202. - 2. Fitzgerald, P. R. Coccidia in Hereford Calves on Summer and Winter Ranges and in Feedlots in Utah. J. Parasitol. 48 (1962): 347-351. - 3. Fitzgerald, P. R. The Economics of Bovine Coccidiosis. Feedstuffs 44, (1972): 28-29. - 4. Foster, A. O. The Economic Losses Due to Coccidiosis. Am. N.Y. Acad. Sci. 52, (1949): 434-442. - 5. Niilo, L. Bovine Coccidiosis in Canada. Can. Vet. J. 11, (1970): 91-98. - 6. Swales, W. E., D. W. Baker, H. E. Kemper, R. E. Rebrassier, and R. D. Turk. Report of the Committee of Parasitology 1, J. Am Vet. Med. Assn. 113, (1948): 235-239. - 7. U.S. Dept. of Agriculture. Mid-year Cattle Inventory Report. July 1, 1973.