

Coccidiosis or Coccidiasis?

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Coccidia Are Present In Every Poultry House Anywhere In The World

Coccidia Are Present In Every Poultry House Anywhere In The World

Reproductive Potential

1 oocyst can produce

- *E. acervulina* 400,000
- *E. maxima* 12,000
- *E. tenella* 72,000

• Day 20 ~ 30,000 oocyst/ gram litter

• 1 sq. ft. built up litter weighs ~ 1.5 kg

40 X 400 ft= 16,0000 sq. ft.
~ total oocysts in house
720,000,000, 000

Slide courtesy: G.F. Mathis, Southern Poultry Research

COCCIDIOSIS - DEFINITION

Coccidiosis is a common parasitic disease of the intestinal tract or ceca of chickens and turkeys caused by single-celled protozoan parasites of the genus *Eimeria* which are commonly referred to as coccidia.

OTHER GENERA OF APICOMPLEXAN PARASITES

- » *Isospora*
- » *Haemoproteus*
- » *Leucocytozoon*
- » *Plasmodium*
- » *Toxoplasma*
- » *Sarcocystis*
- » *Wenyonella*
- » *Tyzzeria*
- » *Cryptosporidium*

COCCIDIOSIS VS. COCCIDIASIS

There are 2 types of coccidiosis:

Clinical coccidiosis where the affected birds show typical symptoms of disease, such as bloody droppings and increased mortality and

Subclinical coccidiosis where the affected birds do not show visible symptoms of the disease but the gross lesions and the coccidia are present.

COCCIDIOSIS VS. COCCIDIASIS

Because in most cases the feed chickens and turkeys consume is supplemented with anticoccidial drugs, cases of clinical coccidiosis are not nearly as common as those of subclinical coccidiosis.

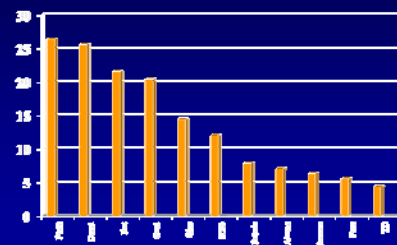
For this reason, subclinical cases of coccidiosis are much more prevalent and harder to diagnose and treat and the performance of these flocks is substandard.

COCCIDIOSIS VS. COCCIDIASIS

The prevalence of subclinical coccidiosis is most frequently monitored by conducting "cocci checks".

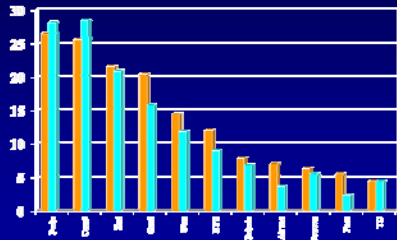
Extremely good performance responses to diclazuril observed by many companies following its introduction clearly illustrated the significant adverse effects of subclinical coccidiosis on flock performance.

Incidence of Subclinical Diseases U.S. Broilers - Overall Ranking (%)



Cervantes, H., WPDC, 2002

U.S. Broilers Overall Ranking (%) 2002 vs. 2006



Cervantes, H., AVMA/AAAP, 2006

Occasionally Outbreaks of Coccidiosis Occur in Caged Layers

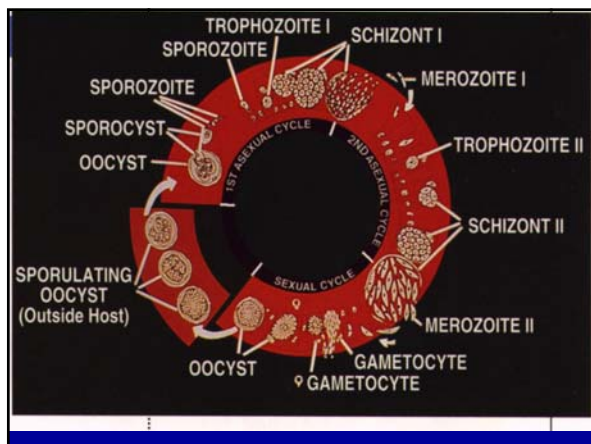


MOST COMMON COCCIDIA IN BROILERS

- » *Eimeria acervulina*
- » *Eimeria maxima*
- » *Eimeria tenella*

OTHER COCCIDIA

- » *Eimeria brunetti*
- » *Eimeria necatrix*
- » *Eimeria mitis*
- » *Eimeria praecox*



SIGNS OF COCCIDIOSIS

- Typical sick bird attitude.
- Inadequate pigmentation (pale shanks).
- Anorexia (loss of appetite).
- Huddling under brooders.
- Ruffled feathers, soiled vent.
- Enteritis/flushing and wet litter.
- Impaired nutrient absorption/feed passage.

ADVERSE EFFECTS ON BROILER PERFORMANCE

- ↓ weight gain; ↑ feed conversion.
- ↑ mortality.
- Secondary infections.
- ↑ medication cost.
- Bloody droppings.
- Anemia.
- Sudden death.



DISEASES OR CONDITIONS THAT MAY LOOK LIKE COCCI

- Pale bird/malabsorption syndrome/RSS.
- Mycotoxicosis.
- Clinical and subclinical NE.
- Enteric salmonellosis.
- Enteric colibacillosis.
- Classical IBD.

DISEASES OR CONDITIONS THAT MAY LOOK LIKE COCCI

- Consumption of poor quality feed (i.e., rancid fat, soybean meal with high levels of tripsin inhibitors).
- Excess salt in feed.
- Enteric viruses.
- Other internal parasites.
- Non-specific enteritis.

ASSESSING THE CHALLENGE AND THE EFFICACY OF ANTICOCCIDIAL PROGRAMS

- Always follow the same procedure.
- Examine 5 birds per house (avoid culls).
- Check 2 or more farms per age group.
- Check 2, 3, 4, 5, 6, 7 & 8 week-old birds.
- Carefully inspect the outside and inside of the gut for gross lesions of coccidiosis.
- Always scrape the mid-gut to look for *E. maxima* oocysts with a microscope.

ASSESSING THE CHALLENGE AND THE EFFICACY OF ANTICOCCIDIAL PROGRAMS

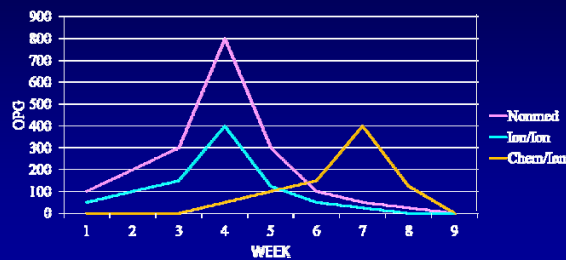
- Look for typical gross lesions.
- Always score from 0 (no lesions) to +4 (most severe lesions).
- Always scrape the gut and look for oocysts under the microscope to confirm *E. maxima*.
- If anticoccidial failure is suspected, always collect and assay a feed sample for drug content.



ASSESSING THE CHALLENGE

- Keep in mind that onset of lesions may shift to a later period when a strong chemical drug is used in the starter feed.

PEAK OOCYST PRODUCTION OOCYST NUMBERS



ASSESSING THE CHALLENGE

- Oocyst counts:
Litter vs. droppings
- Sensitivity limit:
100 oocysts/gram

Oocyst Counts (OPGs)

- Impending risk:

E. acervulina 100,000

E. maxima 10,000

E. tenella 70,000

EXPERIMENTAL PARASITOLOGY 28, 30-36 (1970)

Anticoccidial Drugs: Lesion Scoring Techniques in Battery and Floor-Pen Experiments with Chickens

Joyce Johnson and W. Malcolm Reid

Department of Poultry Science, University of Georgia, Athens, Georgia 30601





JOHNSON, JOYCE, AND REID, W. MALCOLM. 1970. Anticoccidial drugs: Lesion scoring techniques in battery and floor-pen experiments with chickens. *Experimental Parasitology* 28, 30-36. Although lesion scoring is a commonly accepted criterion for determining the pathogenicity of coccidial species, no previous attempt has been made to standardize and describe the scoring scale. In battery trials using pure species, the six species *Eimeria tenella*, *E. necatrix*, *acervulina*, *E. mitati*, *E. maxima*, and *E. brunetti* have been scored on a 0 to +4 scale with descriptions of the gross pathologic changes for each score. *Eimeria maxima* and *E. brunetti* were found to be the most difficult species to score since the gross pathologic picture has been difficult to correlate with weight gains or other indications of pathogenicity. Birds from floor-pen trials infected with more than one species were also graded on a 0 to +4 scale. Four sections of the intestine (upper, middle, lower, and ceca) were each scored separately. No attempt was made to determine species, but microscopic examination of scrapings was made to confirm the presence of coccidia.

INDEX DESCRIPTORS: Pathogenicity; Coccidiosis; *Eimeria tenella*; *E. necatrix*; *E. acervulina*; *E. mitati*; *E. maxima*; *E. brunetti*; Chemotherapy; Pathology; Techniques.

LESION SCORING REGIONS

- Upper region = Duodenum and upper jejunum.
- Middle region = Jejunum (mid and lower jejunum).
- Lower region = Ileum and rectum.
- Cecal region = Ceca.

J. Johnson & W.M. Reid, 1970.

DIFFERENTIAL CHARACTERISTICS FOR 4 SPECIES OF CHICKEN COCCIDIA				
CHARACTERISTICS	<i>E. scrofulina</i>	<i>E. maxima</i>	<i>E. necatrix</i>	<i>E. tenella</i>
ZONE			large intestine, no oocysts	
PARASITIZED				
MICROSCOPIC LESIONS	with a broad, shallow, and irregular depression in the mucosa of the large intestine, through which numerous flattened oocysts pass	shallow, well-defined, smooth, oval-shaped depression	small, well-defined, oval-shaped depression, through which numerous flattened oocysts pass	small, well-defined, oval-shaped depression, through which numerous flattened oocysts pass

Reference: Diseases of Poultry, 1991



COCCIDIOSIS COMPARISON

CLINICAL
COCCIDIOSIS

SUBCLINICAL
COCCIDIOSIS

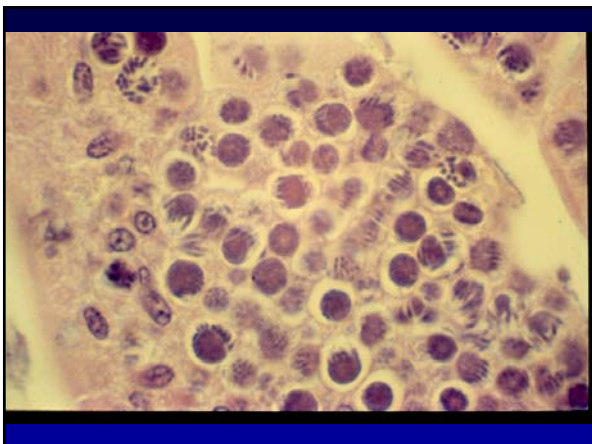
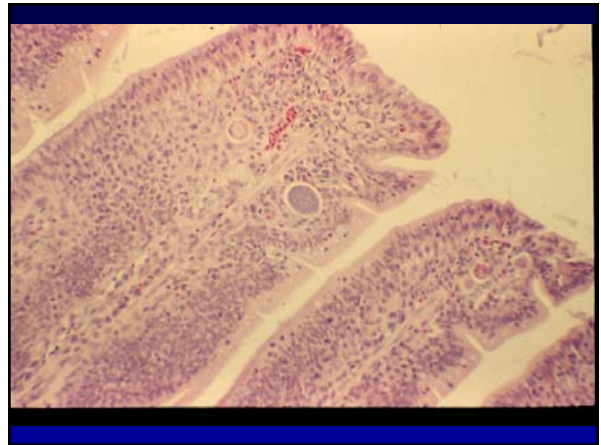
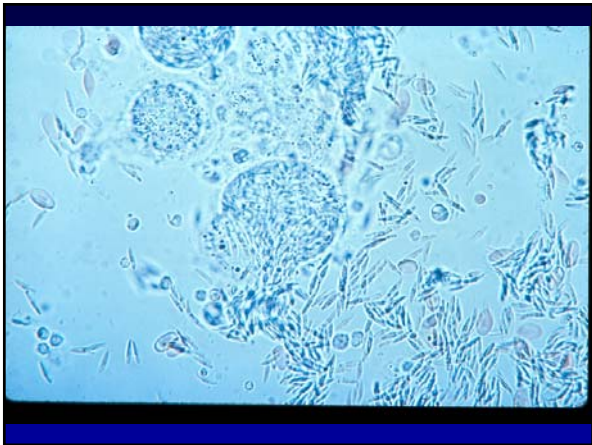
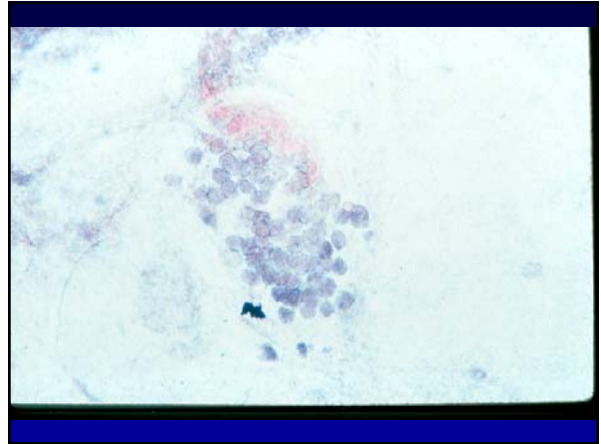
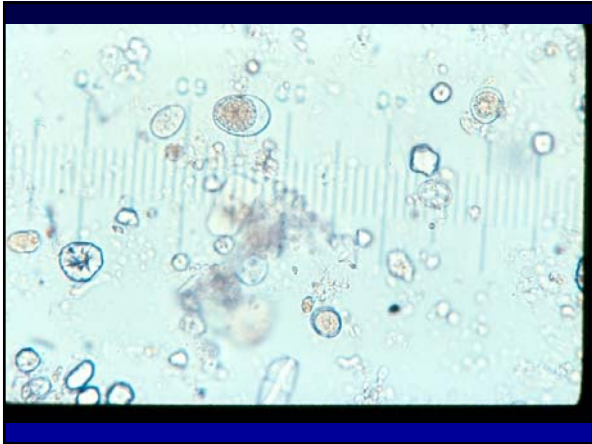


COCCIDIOSIS COMPARISON



CLINICAL
COCCIDIOSIS

SUBCLINICAL
COCCIDIOSIS





COCCIDIOSIS COMPARISON

CLINICAL COCCIDIOSIS	SUBCLINICAL COCCIDIOSIS
	
	E. tenella +1
	COCCIDIASIS?

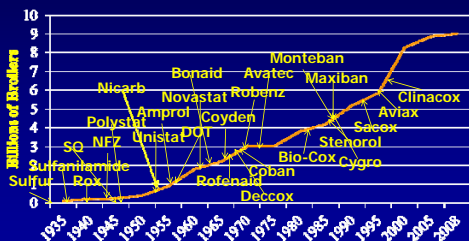
COCCIDIOSIS CONTROL OBJECTIVES

- **Broilers:**
Control infection to maximize performance, immunity development is secondary.
- **Breeder pullets and table-egg layers:**
Controlled exposure to ensure protective immunity in all pullets by 12 weeks of age.

COCCIDIOSIS PREVENTION PROGRAMS

- **Chemoprophylaxis:**
Chemical anticoccidials.
Ionophore anticoccidials.
Chemical + Ionophore anticoccidials.
- **Vaccination:**
Live attenuated and non-attenuated vaccines.

USA Broiler Production & Introduction of Anticoccidials



COCCIDIOSIS PREVENTION PROGRAMS CHEMOPROPHYLAXIS - IONOPHORES

TRADE NAME	IONOPHORE	MANUFACTURER
Aviax II	Semduramicin	Phibro
Sacox	Salinomycin	Huvepharma
Bio-Cox	Salinomycin	Pfizer
Avatec	Lasalocid	Pfizer
Coban	Monensin	Elanco
Monteban	Narasin	Elanco

COCCIDIOSIS PREVENTION PROGRAMS CHEMOPROPHYLAXIS - CHEMICALS

TRADE NAME	CHEMICAL	MANUFACTURER
Nicarb	Nicarbazine	Phibro
Amprol	Amprolium	Huvepharma
Robenz	Robenidine	Pfizer
Zoamix	Zoalene	Pfizer
Coyden	Clopidol	Huvepharma
Clinacox	Diclazuril	Huvepharma

CHEMOPROPHYLAXIS

- **Straight** programs
The same anticoccidial is used until withdrawal.
- **Shuttle** programs
One anticoccidial is used in the starter feed
Another anticoccidial is used in the grower feed.
- **Set-up** programs
Start with a lower level of the anticoccidial and increase it during peak challenge (3-4 weeks).

CHEMOPROPHYLAXIS

- **Step-down** programs
The concentration of the anticoccidial is lowered in the latter feed(s).
- **Rotational** programs
The anticoccidial drug is changed every 3, 4 or 6 months resulting in 4, 3 or 2 rotations per year.

IONOPHORE ANTICOCIDIALS CHARACTERISTICS

- They allow some coccidiosis to occur.
- The level of coccidiosis allowed has a minimal adverse effect on flock performance.
- The low-grade cycling of coccidia is commonly referred to as a "leakage" and it allows a gradual development of immunity.
- The coccidia are not under selection pressure and are not as likely to mutate and develop resistance.

IONOPHORE ANTICOCIDIALS CHARACTERISTICS

- This prolongs the anticoccidial's useful life.
- Ionophores are versatile, they can be used in straight, shuttle, step-up, step-down and rotational programs.
- Some are cleared for use in breeder and layer pullets.
- Most of them benefit from the addition of 3-nitro to the feed.

CHEMICAL ANTICOCIDIALS CHARACTERISTICS

- Typically this type of anticoccidial do not allow coccidiosis to occur (except a few like Nicarb).
- Birds do not develop immunity.
- The coccidia are under selection pressure and are more likely to mutate and develop resistance to the drug.
- The resistance problem reduces the drug's efficacy and its useful life.

CHEMICAL ANTICOCIDIALS CHARACTERISTICS

- Drug resistance may develop completely and suddenly, the consequences can be devastating.
- They are best used in shuttle programs (usually in the starter feed) and rotational programs.
- They are usually not used for more than one or two cycles.
- Most of them benefit from the addition of 3-nitro to the feed.

ASSESSING THE NEED FOR TREATMENT

- Use **incidence** of coccidiosis and **severity** of gross lesion scores to determine when to treat.
- Always use a drug that is effective against the *Eimeria* species that you are dealing with.
- Always read the medication label.
- Always comply with drug withdrawal requirements.

WHEN TO TREAT FOR COCCI: A GENERAL RULE OF THUMB

Birds should be treated for coccidiosis when:

Eimeria acervulina or *E. maxima*
Lesion scores are +2 or higher in 80% of the birds.

Eimeria tenella lesion scores are +2 or higher in 20% of the birds.

COCCIDIOSIS TREATMENT

Each species and/or strain of coccidia reacts differently to every drug.

Therefore, one drug may be more effective than another one in controlling a particular field challenge.

In general, *Eimeria tenella* is more sensitive to amprolium water medications than to sulfas.

COCCIDIOSIS TREATMENT

In general, *E. acervulina*, *E. maxima* and *E. necatrix* are more sensitive to sulfas than to amprolium water medications.

Full details of drugs available and treatment regimens are available in the paper hand-out.

COCCIDIOSIS PREVENTION PROGRAMS

VACCINES

TRADE NAME	TARGET BIRD	MANUFACTURER
Coccivac – B	Broilers & roasters	MERCK
Coccivac – D	Layers & breeders	MERCK
Coccivac – T	Turkeys	MERCK
Immucox Chickens I	Broilers & Roasters	CEVA
Immucox Chickens II	Breeders & Egg Layers	CEVA
Immucox for Turkeys	Turkeys	CEVA
Advent	Broiler chickens only	Viridus (NOVUS)
Inovocox	Broiler chickens only	Embrex
Hatchpack Cocci-III	Broiler chickens only	MERIAL

COCCIDIOSIS PREVENTION PROGRAMS

VACCINES

VACCINE	EIMERIA SPECIES INCLUDED
Coccivac – B	Ace, Max, Miv, Ten
Coccivac – D	Ace, Bru, Max, Mit, Miv, Nec, Pra, Ten
Coccivac – T	Ade, Dis, Gal, Mel
Immucox for Chickens I	Ace, Max, Nec, Ten
Immucox for Chickens II	Ace, Bru, Max, Nec, Ten
Immucox for Turkeys	Ade, Mel
Advent	Ace, Max, Ten
Inovocox	Ace, Max, Ten
Hatchpack Cocci-III	Ace, Max, Ten

COCCIDIOSIS PREVENTION PROGRAMS

VACCINES

VACCINE	ADMINISTRATION METHOD
Coccivac – B	Spray cabinet, Eye spray, Feed or Water
Coccivac – D	Spray cabinet, Eye spray, Feed or Water
Coccivac – T	Spray cabinet, Eye spray, Feed or Water
Immucox for Chickens I	Gel
Immucox for Chickens II	Gel
Immucox for Turkeys	Gel
Advent	Spray cabinet or Feed
Inovocox	<i>In-ovo</i> injection
Hatchpack Cocci-III	Spray cabinet

COCCIDIOSIS PREVENTION PROGRAMS

VACCINES

- Primarily used during summer time in heavy broilers or in "organic" or drug-free chickens
- None of the vaccine manufacturers are recommending routine use of amprolium post-vaccination
- Vaccines appear to produce more consistent results when used on built-up litter
- Performance (feed conversion) may suffer, possibly due to lesions and lack of antibiotic effect from the removal of the ionophore anticoccidial (sometimes used in conjunction with an anticoccidial)

COCCIDIOSIS PREVENTION PROGRAMS

VACCINES

- Typically not used to improve performance (controlled infection), vaccine-induced lesions may predispose birds to NE
- Addition of an antibiotic with good antiostridial activity like virginiamycin (Stafac®) in the feed is recommended to prevent NE and maintain good performance
- Viable rotational alternative (summer time)
- May restore sensitivity to ionophore anticoccidials
- Good responses to ionophore anticoccidials following vaccine use have been reported

COCCIDIOSIS PREVENTION PROGRAMS

VACCINES

- Vaccine storage, mixing and administration is critical
- Uniformity of vaccine administration is critical
- Uniform administration ensures the delivery of a protective dose to each bird
- Uniform administration prevents "post-vaccination reactions" and the need for half-dose treatments with amprolium that may interfere with the development of immunity

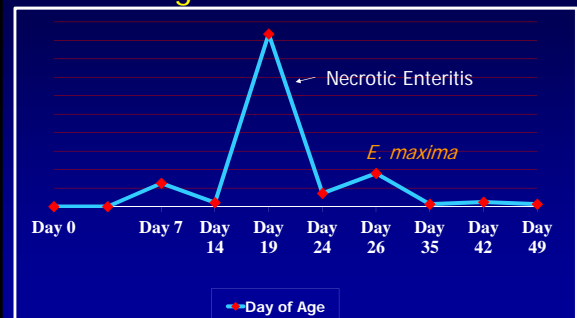
COCCIDIOSIS PREVENTION PROGRAMS

VACCINES

- Newest spray vaccination method for the hatchery is by gel-spray
- Newest injection vaccination method is "in-ovo" into 18 day-old chicken embryos at the hatchery during transfer



Daily Oocyst Shedding Pattern Following Coccidiosis Vaccination



VACCINATION

KEY POINTS

- Vaccine for broilers and breeder pullets should preferably contain only the species endemic in the area.
- Following early vaccination *E. acervulina*, *E. maxima* and *E. tenella* gross lesions may be found from 6 days postvaccination until day 35.
- To limit the damage induced by the vaccine, the administration of amprolium 10 days p.v. at a half level was often recommended. Sometimes a 2nd treatment was needed during the 4th or 5th week .

COCCIDIOSIS PREVENTION

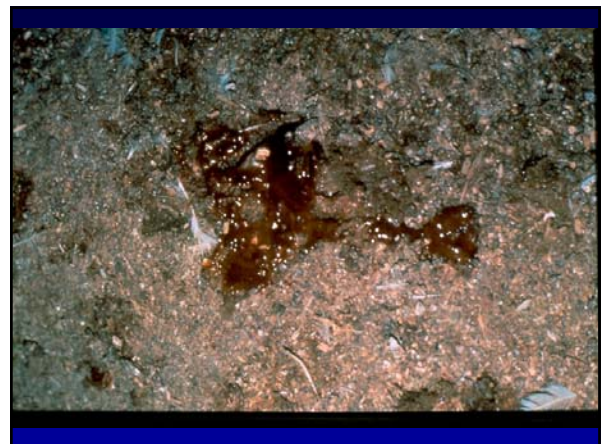
MANAGING THE ENVIRONMENT

- Under suitable environmental conditions, oocysts sporulate and become infectious within 24-48 hours.
- Keeping the proper balance between ventilation and heat will help reduce sporulation by maintaining drier litter.
- Management factors like the periodic raking and removal of caked litter, proper height, pressure and maintenance of nipple drinkers will aid to keep drier litter.

COCCIDIOSIS PREVENTION

MANAGING THE ENVIRONMENT

- If stocking density is high and oocyst sporulation fast the challenge may overwhelm any product, especially if the birds are immunosuppressed by IBDV, CIAV, MDV, aflatoxins, etc.
- Inevitably, wet litter leads to faster and higher rates of oocyst sporulation and higher challenge.
- This is one reason for which coccidiosis is still usually a bigger problem during the cold or rainy months of the year.





MANAGING COCCIDIOSIS

SUMMARY

- Coccidiosis remains today the most frequently diagnosed subclinical disease of broiler chickens.
- The estimated global cost to broiler producers for prevention and control programs is \$300 M.
- The estimated global economic losses on broiler performance are at least \$3 billion.
- Therefore, it is of critical importance to monitor on a routine basis the prevalence of this disease through routine "cocci checks".
- Changes to anticoccidial programs should be based on necropsy findings and flock performance results.

MANAGING COCCIDIOSIS

SUMMARY

- There are no new anticoccidial drugs in development due to the expense involved and the uncertainties of the current regulatory environment.
- Therefore, the current anticoccidial drugs must be used in the most rational programs to maintain and extend their effective useful life.

THE END

Thank you for your
attention

Questions?

