

# COCCI FORUM

NEW STRATEGIES FOR COCCIDIOSIS MANAGEMENT



## CHARTING THE COURSE FOR INTESTINAL HEALTH

PLUS

SENSITIVITY TRIAL RESULTS

FLEXIBILITY AT MARTINI ALIMENTARE

DATA CONFIRM VACCINE PERFORMANCE

COCCI FAQs: ANSWERS TO YOUR QUESTIONS

SPAH-PBU-378

 Schering-Plough Animal Health

NUMBER 10

**Traditional Concepts  
Not Coping With  
Your Current  
Intestinal Challenges?**



**IDEA**

A novel nutritional and management concept for birds vaccinated with Paracox<sup>®</sup>-5 or Coccivac<sup>®</sup>-B.

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# COCCI FORUM

NUMBER 10

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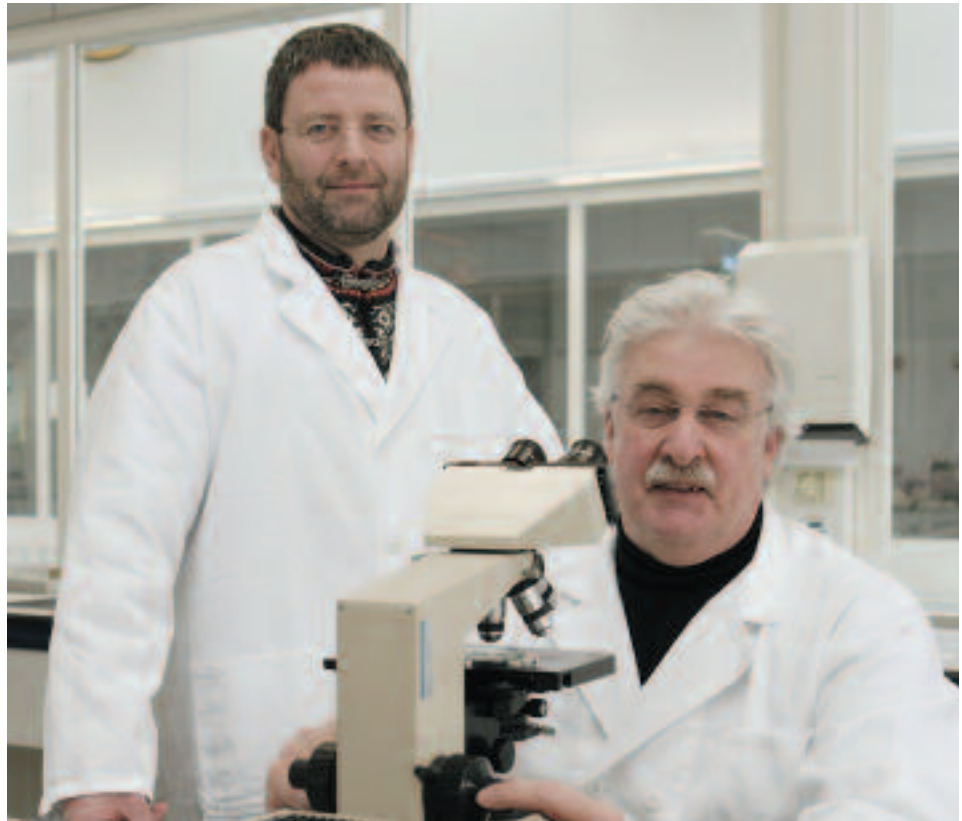
*Cover: More than 60 nutritionists from around the globe took to the high seas off Madeira, Portugal, in March to explore the new world of broiler nutrition made possible by coccidiosis vaccination. This view from a replica of Christopher Columbus' Santa Maria provided added inspiration. For the full story, turn to our special report beginning on page 10.*

*Photo by Joseph Feeks.*

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## SENSITIVITY TRAINING

European study backs earlier work in US showing that coccidiosis vaccination restores *Eimeria* sensitivity



Landman and Peek: 'Resistance is a problem of increasing importance.'

Coccidiosis vaccination appears to restore the sensitivity of European coccidial field isolates to commercial in-feed anticoccidials, according to the results of a study conducted by a leading animal health institute.

“For poultry producers, restoration of sensitivity would enable better, more efficient use of anticoccidial drugs and improved coccidiosis control,” says Dr. W.J. Landman, an investigator in the study, conducted by the Animal Health Service Ltd. Poultry Health Centre, the Netherlands, one of the largest and best equipped animal diagnostic laboratories in the world.

In-feed anticoccidials have long been the primary method of controlling *Eimeria*, the protozoan coccidial parasite that causes coccidiosis in poultry, but widespread resistance to the drugs has developed after continuous usage, say Landman and his associate in the study, H.W. Peek.

The investigators have researched the sensitivity of coccidia in poultry since the late 1980s. In 2003, they published the results of an extensive survey with coccidial isolates harvested in the Netherlands from 1996 to 2001 and reported extensive resistance to commercial anticoccidials. A paper published in 2004 showed similar results

for isolates taken from Spain and Germany. Other researchers have also documented anticoccidial resistance, Landman says.

### Resistance impedes efficient coccidiosis control

“Resistance is a problem of increasing importance that is impeding the efficient prevention of coccidiosis,” Landman and Peek say.

Because anticoccidial resistance can affect flocks gradually, some poultry producers are not aware of the problem or that flock performance is not as good as it could be; others live with the reduced performance caused by coccidiosis, Landman says. “Sometimes, the resistance is not absolute and the infection is tempered, but it’s there,” he adds.

In the United States, it is well documented that coccidial sensitivity to anticoccidial drugs can be restored with the use of coccidiosis vaccination, which replaces wild field strains with drug-sensitive strains. In Europe, however, the recent study by Landman and Peek is believed to be the first of its kind to show that vaccination can restore anticoccidial sensitivity in the field.

In their most recent study, they determined anticoccidial drug sensitivity for 21 *Eimeria* field isolates originating from broiler farms in Denmark, Germany, Great Britain, Greece, Italy, Portugal and Romania. The isolates were supplied by Schering-Plough Animal Health Corporation. The in-feed anticoccidials tested were diclazuril (Clinacox) and monensin (Elancoban).

There were four groups of nine chicks that each received the following:

- **Group 1:** Infected, received diclazuril at a dose of 1 mg/kg in feed
- **Group 2:** Infected, received monensin at a dose of 100 mg/kg in feed
- **Group 3:** Infected but not treated

**Table 1. Sensitivity findings of three *Eimeria* species to diclazuril and monensin.**

	Diclazuril	Monensin
<i>E. acervulina</i> (20)	14 resistant (70%) 1 reduced sensitivity 5 sensitive	11 resistant (55%) 5 reduced sensitivity 4 sensitive
<i>E. tenella</i> (13)	3 resistant (23%) 1 reduced sensitivity 9 sensitive	5 resistant (38%) 3 reduced sensitivity 5 sensitive
<i>E. maxima</i> (17)	7 resistant (41%) 1 reduced sensitivity 9 sensitive	8 resistant (47%) 2 reduced sensitivity 7 sensitive

with anticoccidials (positive control)

- **Group 4:** Not infected and not treated (negative control)

At 8 days of age, the investigators exposed the first three groups to a defined number of sporulated oocysts (oocysts capable of releasing viable spores) prepared from the *Eimeria* field isolates. The isolates in the study were *E. acervulina*, *E. tenella* and *E. maxima*, which are all known to cause clinical coccidiosis in chickens.

The two treated groups started on medicated feed 2 days before the challenge and continued until the end of the experiment. The researchers conducted a chemical analysis of the anticoccidial products in the feed to assure that product concentrations were close to the desired dose.

*continued on page 26*

**Table 2. More *Eimeria* isolates were sensitive to anticoccidials that were from vaccinated flocks.**

Anticoccidial	<i>E. acervulina</i>	<i>E. tenella</i>	<i>E. maxima</i>
Diclazuril	4 of 8 <sup>V</sup>	8 of 8 <sup>V</sup>	8 of 9 <sup>V</sup>
	1 of 12 <sup>NV</sup>	1 of 5 <sup>NV</sup>	1 of 8 <sup>NV</sup>
Monensin	4 of 8 <sup>V</sup>	4 of 8 <sup>V</sup>	5 of 9 <sup>V</sup>
	0 of 12 <sup>NV</sup>	1 of 5 <sup>NV</sup>	2 of 8 <sup>NV</sup>

<sup>V</sup> = From vaccinated flocks

<sup>NV</sup> = From nonvaccinated flocks

## SCHERING-PLOUGH'S TECH SERVICE TEAM ANSWERS QUESTIONS ABOUT MANAGING COCCIDIOSIS IN BROILERS



*Charles Broussard, DVM*

**Q.** WHICH TECHNOLOGY DOES SCHERING-PLOUGH RECOMMEND TO HELP ENSURE EFFICIENT, UNIFORM APPLICATION AND SUCCESSFUL COCCIDIOSIS CONTROL?

**A.** The best method of applying Paracox has evolved as knowledge and technology have permitted. Initially, the water application method was used, then the spray-on-feed method and, now, hatchery spray when possible is recommended.

The Spraycox 2 machine with the dual nozzle system for application on chicks has improved vaccination coverage by utilizing a more efficient spray pattern, which increases the amount of vaccine applied directly to the chicks. Our new AirMix technology (see page 32) keeps the vaccine's oocysts suspended to ensure optimum performance.



*Steve Fitz-Coy, PhD*

**Q.** WHY SHOULD I USE COCCIVAC-B FOR THREE GROW-OUT CYCLES INSTEAD OF TWO?

**A.** Actually, there is no maximum number of Coccivac-B grow-out cycles for any given operation.

Data collected from an industry reporting service in 2003 and 2004 show that Coccivac-B programs outperform standard anticoccidial programs in all major flock performance parameters, even during the hottest months of the year.

More companies are realizing this advantage and are considering extension of their Coccivac-B summer pro-

grams well into winter. A few complexes have used Coccivac-B year-round with great success.

Company nutritionists are beginning to realize that they have more opportunities to use creative diets once restrictive, in-feed anticoccidials are removed from the formulation equation. With the recent paradigm shift from in-feed anticoccidials to Coccivac-B, the possibilities for maximizing flock performance are endless, and many of them are already coming to fruition.

**Q.** WHAT IS THE MINIMUM TARGET WEIGHT OF BIRDS THAT CAN RECEIVE COCCIVAC-B AND STILL PRODUCE POSITIVE ECONOMIC RETURNS?

**A.** Currently, Coccivac-B is being successfully used in flocks grown to live weights greater than 4.5 lbs. Well-managed operations have had success with Coccivac-B in small bird weight complexes.

Vaccine application and flock management tend to be more critical in small bird weight (<4.5 lbs) operations because of tighter densities and higher levels of coccidial field challenges. Densities are higher because birds are placed based on pounds per square feet in most poultry operations. But, with respect to oocyst output, the number of birds per square feet is more important because each bird is literally a coccidial, oocyst-producing machine.

In general, the more birds there are per square feet, the more oocysts there are per square feet; yet, if the coccidial field challenge is under control and birds are properly vaccinated and managed, small weight flocks tend to do well on a Coccivac-B program.



*John McCarty, DVM*

**Q.** WOULD THE USE OF ROXARSONE (3-NITRO) IN BROILER FEEDS HAVE A NEGATIVE IMPACT ON IMMUNITY TO COCCIDIOSIS AFTER COCCIVAC-B VACCINATION?

**A.** No. The use of roxarsone in broiler feeds has no adverse effect on immunity to coccidiosis after Coccivac-B vaccination. On the contrary, roxarsone can be used in feed to enhance performance in vaccinated broilers.

In addition, research at Colorado Quality Research has shown that in Coccivac-B vaccinated birds, roxarsone has a positive impact on live production performance parameters such as weight gain and feed conversion ratio.

**Q.** HOW SHOULD COCCIVAC-VACCINATED FLOCKS BE MONITORED AFTER VACCINATION?

**A.** A representative number of Coccivac vaccinates should be monitored by postmortem examination when the first vaccinated flocks reach 21 days of age. Vaccinates should demonstrate coccidial lesions within the expected vaccination profile. A representative number of Coccivac vaccinates should again be monitored by post-mortem exam when the first vaccinated flocks reach 28 days of age. Vaccinates should demonstrate resolution of coccidial lesions within the expected vaccination profile.

Vaccinates 7 through 21 days of age should also be observed in the field for signs of necrotic enteritis or management practices that are incompatible with controlled vaccine cycling.

Thereafter, flocks should be monitored by monthly postmortem sessions including representatives from 14 days

of age through slaughter, with an emphasis on ages 21 through 35 days.

**Q.** CAN THE RATION FORMULATION IMPROVE RESULTS WITH VACCINATION?

**A.** Yes. The ration formulation can be designed to maximize growth in Coccivac vaccinates and it can minimize secondary bacterial challenges that could induce enteritis.

Data suggest that improved levels of total sulfur amino acids in the first 2 to 3 weeks is linked to better performance in broilers receiving Coccivac-B. Extra fortification with fat-soluble vitamins (D and E) during peak vaccinal oocyst cycling may improve performance. Vitamin D supplemented at 40,000 to 60,000 IU in the starter feed is recommended.

The ration must be formulated to enhance growth from day 28 through slaughter, maximizing compensatory gain. Very low protein diets should be avoided. Pay special attention to the digestibility of raw materials in the starter feed.

Subtherapeutic levels of antibiotics with anticlostridium activity (bacitracin, virginiamycin, etc.) or with the ability to manage intestinal microflora composition (bambermycin) are highly recommended during the immunity-building phase of vaccination to prevent secondary necrotic enteritis.

If wheat, barley or rye is a significant ration component, appropriate enzymes should be incorporated to minimize the incidence of necrotic enteritis by removing fish meal or animal proteins.

Do not use any drugs with anticoccidial activity for the first 2 weeks after vaccination in broilers and for at least 4 weeks after vaccinating other long-life birds, such as broiler breeders.



*Linnea Newman, DVM*



*Rick Phillips, DVM*



*John Radu, DVM*

## SAFETY NET

### Coccidiosis vaccination helps Martini Alimentare market birds with confidence and flexibility

**F**or Dr. Corrado Longoni, choosing the right product for coccidiosis management goes beyond disease control and bird performance. Food safety is his highest priority.

“I have two babies at home,” says the poultry veterinarian for Martini Alimentare, Longiano, Italy, a major poultry company located in the north-eastern part of the country, about 100 km (62 miles) southeast of Bologna.



“When I go down to our company slaughterhouse to buy chicken for my family, I do it with confidence because I know our product is safe and free of drug residues. Food safety has to be our first priority — for us, for our customers and for the image of the poultry industry.”

It’s hard to argue with Longoni’s logic, but producing and marketing residue-free poultry hasn’t always been

easy — especially when using medicated feeds to control coccidiosis.

While these treatments are approved by regulatory authorities, synthetic anticoccidials and ionophores — a group of feed antibiotics used routinely for coccidiosis control — generally have withdrawal times of at least 5 days.

In theory, that’s not a big deal for a poultry company marketing entire houses at the same time. But for a company like Martini, which markets 24 million birds a year at various stages in the growth cycle, the withdrawal times of in-feed anticoccidials can present logistical challenges.

#### Thinning out broilers

In Europe, many operations start thinning out their broiler flocks after 32 days, selling the lighter, less efficient females at different weights — usually 1.7 to 2.4 kg (3.75 to 5.29 pounds) — to meet the demand for smaller birds. They retain the leaner, faster growing, large-breasted males for chicken parts and high-volume commercial sale later in the production cycle.

Practically speaking, it’s difficult to withdraw feed medication from only a portion of the flock because it would leave other females — or, depending on the number of feed lines, the entire house — vulnerable to a costly coccidiosis outbreak.

On the other hand, if the birds are kept on medication until flocks are thinned, there’s a greater risk of birds entering the food chain prior to the drug’s withdrawal time. That can lead to significant penalties, while damaging



the image of the company and the poultry industry.

Martini keeps males and females in the same house but in separate areas. Females are typically thinned out at 35, 42 and 46 days, while the males are slaughtered at 54 to 56 days, usually at 3.5 kg (7.72 pounds).

“Sometimes you need more heavy birds or more lighter birds — it depends on market conditions,” says Giorgio Amedei, live production manager. “That’s why it’s so important for us to remain flexible.

“If we used an anticoccidial in the feed, it would mean having two or three withdrawal periods, which would be very difficult to manage. To play it safe, we had to pull the anticoccidial from the feed at 30 days, which is a long time to go without coccidiosis protection.”

### ‘Can’t take the risk’

Feed mill contamination is another concern when using in-feed anticoccidials. Unless the mill’s lines are flushed after each usage — a process that saps extra time and labor — it’s possible for drugs used in one batch to show up in feeds for other birds or other species.

“Like other producers, we need to be careful because we do not have a feed mill specifically for broiler feeds,” Longoni explains. “Residues from in-feed anticoccidials used in broiler feeds could be toxic to laying hens, breeders or turkeys. We can’t take that risk, nor do we want traces of drugs in our withdrawal feed for broilers.”

Martini was also concerned about wearing out the few in-feed anticoccidials that were still on the market. “We have only two chemicals and three or four ionophores we can use, and we are not sure how much longer those products will be available,” Amedei says. “And without nicarbazin, the ionophores are also less effective.”

Martini, which is also Italy’s second largest feed company, has found a

practical solution to all of these feed-related concerns in poultry: coccidiosis vaccination. By vaccinating day-old birds in the hatchery with Paracox-5 — some 208,000 chicks per week — the company can forget about using in-feed anti-coccidials altogether.

The vaccine is administered by a specially designed spray cabinet, which showers up to 100 chicks at a time with the vaccine. A red dye in the vaccine provides a quick visual indicator that all chicks were vaccinated. The dye also encourages preening among the chicks, which helps to ensure even better distribution of the vaccine.

“The big difference is that the vaccine provides lifelong protection,” Longoni says, “and we no longer have to worry about withdrawal times when we do our thinnings. The vaccine has given us a lot of flexibility without compromising performance or profitability.”

While the vaccine costs more to use than most feed medications, the increase is easily offset by reduced labor in the feed mill and greater marketing flexibility thanks to no withdrawal times.

“There are a lot of hidden, indirect costs associated with using an in-feed anticoccidial,” says Luc Vandi, poultry nutritionist. “For example, you’ll have some feed in the silo with the anticoccidial that you have to take out and bring to another farm. So you can’t just compare the price of the vaccine to drugs. You have to look at the big picture.”

*continued on page 27*



*Longoni: ‘Food safety has to be our first priority’.*



*Amedei: ‘It’s important for us to remain flexible.’*

# WITHOUT A DOUBT

Latest data confirm that vaccination yields equal or better performance than in-feed anticoccidials

Recently released data show that performance in broilers vaccinated for coccidiosis continues to equal or surpass that of broilers on a traditional program with in-feed anticoccidials.

“The latest results corroborate some of the findings from last year’s study and also show that producers are achieving great performance with Coccivac-B, regardless of bird size,”

says Dr. Linnea Newman, a veterinary consultant for Schering-Plough Animal Health Corporation.

“Producers can confidently vaccinate their flocks and expect both protection against coccidiosis and excellent performance,” she says.

## ‘Apples to apples’

This is the second year that performance data has been available from an industry reporting service in the United States. In 2003, the results in broilers vaccinated with Coccivac-B were good, but birds of all weights were lumped together, leaving it difficult to tell with exact certainty how birds in different weight classes were faring, Newman explains.

The latest data, from 2004, separates birds into different weight classes and provides an “apples-to-apples” comparison. “It shows that, without a doubt, vaccinated birds did as well as or better than birds receiving in-feed anticoccidials,” she says.

In the study, birds vaccinated with Coccivac-B were compared to birds of similar weight at different complexes that were on a traditional anticoccidial program. Both groups were compared weekly during the same time, from week 29 (July 18) to week 48 (December 5).

All together, there were 27 complexes — 9 vaccinated, and 18 using a traditional anticoccidial. Processing weight ranged from 5.2 to 6.2 pounds. Key results:

- Mean bird weight of the vaccinated birds was 5.79 lbs, compared to 5.59 lbs for the anticoccidial group.

Figure 1. 42-day mortality (complexes 5.2 – 6.0 lbs).

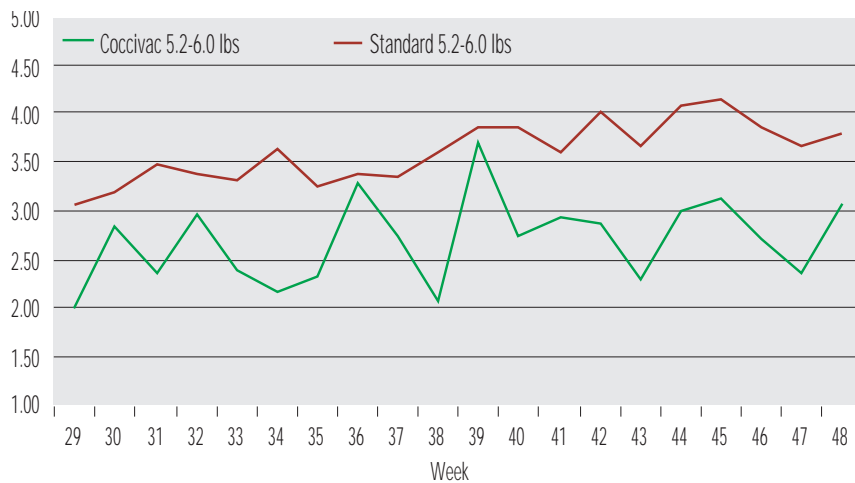
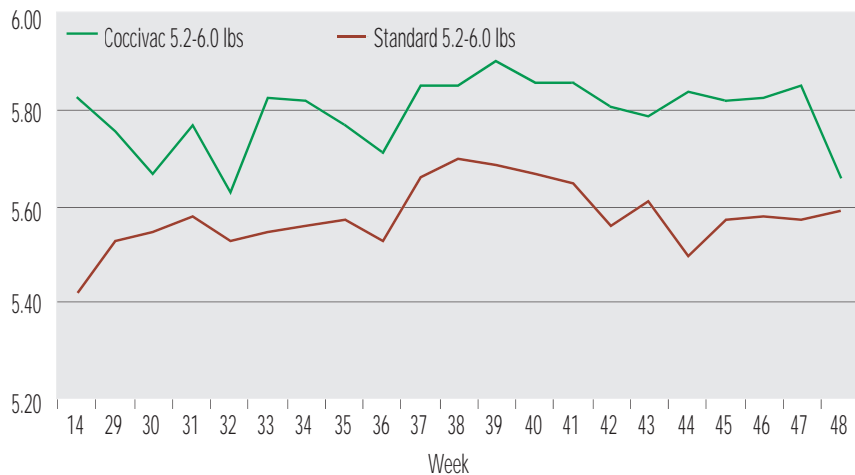


Figure 2. Live bird weight (complexes 5.2 – 6.0 lbs).



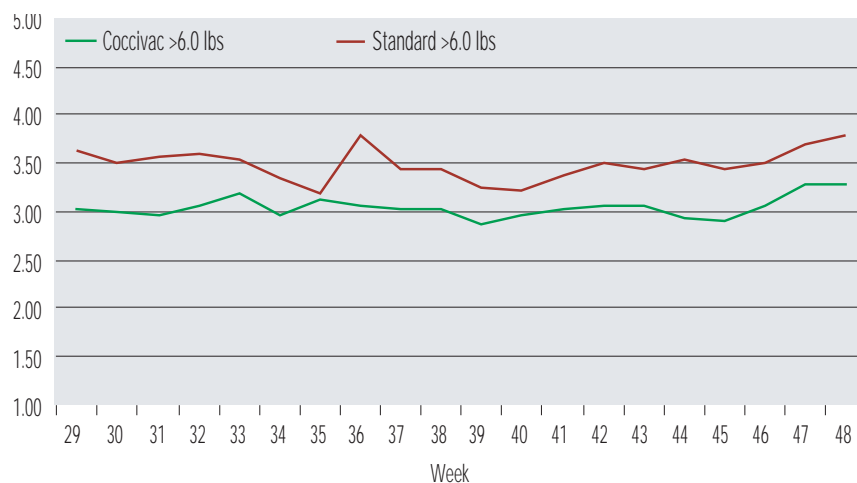
- Vaccinated birds demonstrated better caloric conversion and better livability (Figure 1) in this weight class.
- Vaccinated birds had faster weight gain, averaging 2 days faster to 5 lbs compared to the anticoccidial group (Figure 2).
- The performance index also was better for vaccinated flocks, which had a 0.2 to 0.4 cent advantage compared to birds in the other group.

In the 36 complexes processing birds 6 lbs or more — 15 vaccinated and 21 using traditional anticoccidials — the results were also excellent for coccidiosis-vaccinated birds:

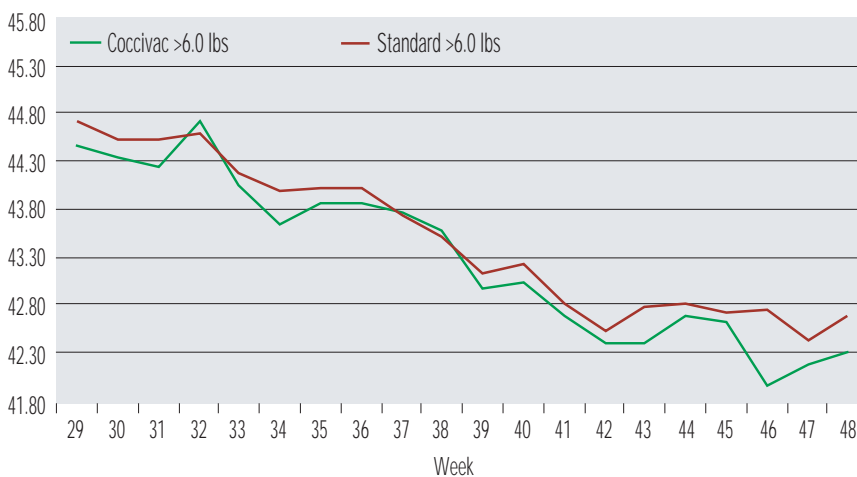
- Mean bird weight was 7.23 lbs in vaccinated birds compared to 7.22 lbs in the anticoccidial group.
- The performance index and feed conversion in vaccinated birds closely matched that of the anticoccidial group.
- Vaccinated birds demonstrated an advantage in livability (Figure 3) and rate of gain (Figure 4) that translated into a slight performance index advantage.

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**Figure 3. 42-day mortality (complexes >6.0 lbs).**



**Figure 4. Days to 5.0 lbs (complexes >6.0 lbs).**



## Coccivac-B Performance in Small Birds Is Similar or Improved

For birds under 5 lbs, the results before and after transition to Coccivac-B within four small bird complexes were compared, Newman says.

Performance was followed from week 10 through week 48. From weeks 10 through 28, a traditional in-feed anticoccidial program was used and from weeks 29 through 48, all complexes were vaccinated with Coccivac-B, she says.

The mean weight among vaccinated birds was 4.77 lbs. After transition to Coccivac-B, the complexes demonstrated similar or improved performance on the performance index, calorie conversion and growth rate (Figure 5).

“Coccivac-B is a viable coccidiosis control option for complexes processing flocks under 5 lbs, just as it is for larger birds,” Newman says.

# special report



## Charting the Course for Intestinal Health

Specialists discuss IDEA concept, address new opportunities for feed management when vaccinating broilers for coccidiosis

**V**accinating for coccidiosis has hatched many new ideas in broiler nutrition as poultry companies break free from the rigid feeding schemes once mandated by in-feed anticoccidials. With more progressive companies leaning toward vaccination as their primary and, in some cases, exclusive means of coccidiosis control, they're finding they can build their nutrition programs around the needs of the birds, not the prescribed regimen or withdrawal time of a coccidiosis drug.

This trend gave birth to the IDEA concept, a new approach to managing broiler feeds. IDEA stands for Impulse, Digestibility, Economic and Advance — all key concepts that make up the concept's foundation.

"The IDEA concept seeks to enhance immunity development and reduce intestinal challenges by coccidia and bacteria with-

out the use of drugs, while also giving poultry companies the opportunity to better manage nutrition for birds," says Fabio Paganini, senior product manager for Schering-Plough Animal Health Corporation. "It potentially reduces feed costs while conditioning the gut for better coccidiosis management."

With these benefits in mind, Schering-Plough Animal Health recently hosted a symposium, "New Paradigms in Poultry Nutrition and Management," in Madeira, Portugal. The event attracted nutritionists from more than 30 leading poultry companies worldwide.

Managing editor Joe Feeks, who attended the conference and then talked with each speaker regarding the take-away messages from their presentation, filed this report. For a free copy of the conference proceedings, send your name, address and phone number to [fabio.paganini@spcorp.com](mailto:fabio.paganini@spcorp.com).

## IDEA: Making nutrition, management and environment part of coccidiosis management

Dr. Rick Phillips  
Schering-Plough Animal Health  
USA

Phillips reviewed the principles of IDEA, insisting it was a “concept” wide open to customization, not a rigid program for all poultry companies to follow.

“We’re trying to bring all the production disciplines such as live production managers, veterinarians, physiologists, and the nutritionists together to talk about the nutritional needs of the birds — not just the good aspects, but those that may have a negative impact on another discipline,” he said.

For example: If management changes a lighting program to help them manage the bird, that could have an impact on feed intake, which could have a negative effect on the bird.

“That might override the positive effect they achieved on the management side,” Phillips said, “so it’s important to have all the production disciplines in the room to talk about the true needs of the birds. That way, poultry companies can put all their recommendations on the table and make sure there aren’t conflicts. This isn’t a new concept, but the industry has gotten away from it over the years. We also know that drugs can also cover up a lot management flaws.”

Phillips reminded the audience that subclinical coccidiosis is still the number one cause of performance loss in the world poultry industry today, either as a primary or secondary disease agent. Without vaccination or other new strategies for coccidiosis control, the full genetic potential of the bird will not be realized, and large amounts of



money will be left “on the table.”

The veterinarian stressed that birds vaccinated for coccidiosis don’t necessarily need more management than those on medicated feeds, but not having drugs in the feed can give nutritionists more flexibility. This, in turn, can lead to more effective and efficient use of various feedstuffs.

*Phillips: ...subclinical coccidiosis is still the number one cause of performance loss in the world poultry industry today...*

“For decades producers have been building their feed program around in-feed anticoccidials, as well as growth promoters,” he said. “Now that we are pulling these drugs away, we have to do things differently — for the simple reason that we’re using products that

work differently. We need the various production disciplines to understand how the vaccine works, how the *Eimeria* pathogens work, and what the host response is to that parasite. Then poultry companies can build a new

*Phillips: With the improved genetic potential of today's birds comes increased demand on the intestinal tract for maximum digestion and absorption.*

program around that new strategy.”

Phillips said resistance problems with overused in-feed anticoccidials, which are generally in the feed from 0 to 35 days, have led to “an erosion of performance” in the field. Vaccination gives producers the opportunity to



“gain some of that back,” he added, by breaking up the continuous use of these products and perhaps eliminating them altogether. Producers can then stop worrying about drug residues in the feed mill and withdrawal times for in-feed anticoccidials, which reduce marketing flexibility.

“As the IDEA concept points out, the first 14 days, 15 to 28 days, and then 30 days and beyond are key windows of time,” Phillips explained. “With IDEA, the nutritionist can look at that time frame and build nutritional packages based on the nutritional needs of the bird, instead of the rotation schedule of the in-feed medications or the withdrawal times of the drugs that were in the feed initially.”

Phillips said that with the improved genetic potential of today's birds comes increased demand on the intestinal tract for maximum digestion and absorption. A comprehensive understanding of the intestinal physiology is therefore imperative. “Trials have confirmed that performance is enhanced when digestibility of the protein fed is improved during the time that immunity is developing,” he added.

The poultry veterinarian then addressed the four components of the IDEA concept, which he called a “simple yet innovative approach to feed management” that redefines the birds’ nutritional and management needs during critical phases of grow-out:

### **Impulse (0-14 days)**

The main focus here is intestinal and immune system development. Optimum protein and energy levels, as well as vitamins and trace mineral supplementation, should be critically reviewed and evaluated in the starter (impulse) feeds, Phillips advised.

“Newly hatched chicks need immediate access to solid feed and water to set the stage for good performance later,” he said. “Birds need to achieve maximum duodenum villi development in the first week.”

In the Impulse stage, intestinal microflora are getting established, and bones and muscles are formed at maximum efficiency. This stage also determines the number of enterocytes for the rest of the birds’ life, so it’s critical to guarantee their maximum development.

### Digestibility (15-28 days)

Intestinal irritation can open the door to secondary invaders, especially bacteria. Abrasive or less digestible ingredients in the grower feeds therefore should be replaced with high quality, highly digestible ones. Dietary changes should be avoided at 15 to 21 days to prevent intestinal disruption

Phillips suggested providing high quality feed and an optimal enzyme dosage, while adjusting protein levels as needed because excess, undigested protein encourages overgrowth of undesirable bacteria. Dietary fat should also be of high quality and easily digestible.

### Economic (>30 days)

Here's where poultry companies can cash in. Immunity is now established and birds have the maximum growth potential. Feed consumption also peaks. The strategy now is to focus on maximizing feed efficiency and daily gain, while the vaccine provides life-long protection against coccidiosis.

### Advance

The implementation of the IDEA concept represents an advancement in the traditional thinking with respect to manipulation of immunization, management and nutrition to help improve overall flock performance.

## IMPULSE: Maximizing the performance of the intestinal tract immune system

*Dr. Andrea Ribeiro*

*Universidade Federal do Rio Grande do Sul  
Brazil*

**I**t might only take 35 to 50 days for a broiler chick to reach market weight, but its intestinal system changes markedly in that brief lifetime.

"The anatomy and the physiology of young chicks are completely different from older birds," Ribeiro said. "They absorb fewer nutrients, so we have to feed them in a different way."

Ribeiro said the chick's intestinal system is not fully developed until 7 to 10 days. "All the feed they eat is to develop the intestinal tract," she explained. "That's very important because the healthier and bigger their intestines, the more nutrients they will absorb in the grow-out period."

She said broilers achieve maximum relative weight of digestive organs when they are between 3 and 8 days of age, with the highest increase in the volume of villi of the duodenum occurring when broilers are 4 days old.



Development of the jejunum and ileum peaks at 10 days, while the highest crypt depth in the duodenum and jejunum occurs at 10 to 12 days.

The passage of feed through the digestive tract of newly hatched chicks also promotes the development of crypt enterocytes, which gradually replace intestinal enterocytes of the

embryo stage. When this replacement is complete, digestion and nutrient absorption reach peak levels.

“That’s why we have to feed them quickly when they arrive in the house,” she continued. “They have to see the food, and the food has to be spread along a big area with no other restrictions. The water has to be clean and fresh, and we need light to stimulate feed intake.”

*Ribeiro: All the feed they eat is to develop the intestinal tract. That’s very important because the healthier and bigger their intestines, the more nutrients they will absorb in the grow-out period.*

Ribeiro cited one published report showing how feed efficiency in poultry has improved 44% since 1978. She also reviewed the digestibility and absorption of carbohydrates, lipids and proteins before discussing the development of the immune system, which begins in the embryo and continues during the first week of life.

Ribeiro cautioned against restricting feed or water during the first 1 or 2 days of life, citing several studies showing the negative impact of such restriction on the birds’ weight gain, efficiency and immunity later in life. “Fasting stimulates the secretion of corticosteroids that inhibit the proliferation of immune cells,” she reported.

Once birds are placed and on feed, it’s important to take steps to maximize feed intake, which can be affected by particle size (0.8 mm is ideal) and levels of energy, sodium and protein. Adequate zinc, selenium, vitamin E and vitamin C are also needed to build a strong immune system.

Water intake, which can fluctuate with water temperature and the mineral levels of the feed, is also critical. Less water intake means less feed intake and opens the door to more health problems, she said.

“Any delay in water and feed consumption promotes depressed immune response,” she warned. Immunity is optimized when vitamin A levels are 10 to 20 times higher than the level suggested for maximum growth. Nutrients available in the yolk sac will vary with yolk size and should not be considered as a primary energy source for chicks.

“Water intake is an area neglected by the majority of poultry operations,” she added. “If the bird doesn’t drink, it doesn’t eat.”

She cautioned against adding minerals to the water because they can make the water bitter and discourage consumption. “So observe your birds, that’s my advice,” she said. “And if they drink, they won’t get dehydrated, a very common problem in small birds. They will also retain water and gain weight.”

In addition to being a good growth promoter, sodium encourages water consumption. It also helps to transport glucose and amino acids to the enteric sites. “I think levels above 0.2% are very important in this first 7 to 10 days,” she added.





## Managing breeder broilers for better immunity development in chicks

Marcus Kenny  
Aviagen Ltd.  
Scotland

**E**arly nutrition of the chick not only involves feeding the chick, but also the breeder. Poultry companies also must consider the effects of incubation practices on both embryo and chick development.

Kenny addressed the importance of feed allocation for breeders, especially with high-performing flocks “producing a lot more hatching eggs than we’ve seen in the past.”

He also discussed the impact of nutrients — not just the higher inclusion rates required by these birds, but also managing them to better support the immune system of the progeny. “I think this is perhaps an important area going forward with the removal of antibiotic growth promoters and the potential removal of coccidiostats,” he said. “We need to be feeding the parents to try to ensure maximum progeny viability and immune system function as well.

“The developing embryo and the hatched chick are completely dependent for their growth and development on nutrients deposited in the egg,” Kenny said. “Consequently, the physiological status of the chick at hatching is greatly influenced by the nutrition of the breeder hen, which will influence chick size, vigor and the immune status of the chick.”

He noted that underfeeding hens can have an impact on chick quality, particularly early in the early production period. Low feed intake by young commercial breeder flocks can compromise nutrient transfer to the egg, resulting in increased late embryonic death, poorer chick viability and uniformity.



Kenny cited one study where broiler breeders were fed different levels through peak production varying from 140 to 175 grams. “Although the increased feed allocation increased body weight, there was no influence on egg size, but chick weight was influenced by feed allocation,” he reported.

Nutrient supply to broiler breeders also impacts chick quality and production performance. “This places greater emphasis on the nutritionist providing the correct nutrient density diet and the flock manager providing appropriate feed intake to the bird coming into lay,” he said.

*Kenny: We need to be feeding the parents to try to ensure maximum progeny viability and immune system function....*

Kenny also said a review of work on fat-soluble vitamins, biotin and pantothenic acid has shown that vitamin E



has the largest impact on progeny. As a general rule, 100 mg/kg vitamin E is a good level for breeder broiler feeds. He said the jury was still out on vitamin C, noting that some experiments suggest a positive response while a more recent study failed to detect any production benefit. Vitamin A, carotenoids, selenium, vitamin D, vitamin K, biotin and pantothenic acid also have been shown to improve bodyweight, enzyme activities, tissue characteristics and immunity of progeny.

*Kenny: Several trials conducted at Aviagen's facilities show that increasing the density of digestible amino acids in broiler starter diets can improve weight gain by 10 gram at 7 days and by approximately 30 to 50 grams at slaughter.*

Calcium, phosphorous, sodium, potassium, magnesium and chloride affect shell quality and naturally lead to

better egg and chick quality. He cautioned, however, that relatively low phosphorous levels in breeder diets may not lead to the best possible bone integrity in the early stages of growth. Feeding breeders supplemental zinc and manganese amino acid complexes appears to improve the liveability of progeny, while selenium has been shown to improve chick quality.

Incubation also affects chick development. "Based on a 39-day growth period, approximately 35% of the growing life of the bird is during the incubation period," Kenny said. Research shows that using a "mean hatch time", rather than 21 days, is a more accurate estimate of the chicks' "starting point." Aiming for a tighter hatch spread will result in better weights at day 1, day 7 and end weights, as well as improvements in uniformity.

Kenny said several trials conducted at Aviagen's facilities show that increasing the density of digestible amino acids in broiler starter diets can improve weight gain by 10 grams at 7 days and by approximately 30 to 50 grams at slaughter.

The feed's physical characteristics can also impact development and growth. Recent trials have shown feeding a meal versus a pellet can depress early feed intake and reduce both early and later body weights by approximately 15%.

"I think we have to create an environment, not just nutritionally but also physically, that will entice the chick to consume as much nutrients as possible," Kenny said. "And that's everything from getting the temperature right to brooding setup to making sure that there's good exposure to good quality, easy-to-consume crumbs."

"Small tweaks and changes in management of broilers, especially in the first 2 or 3 days of life, mean an awful lot in terms of growth at 7 days and consequent kill weights."

## DIGESTIBILITY: Promoting integrity of the intestinal tract and the development of early and effective immunity

Dr. Joaquim Brufau  
IRTA Research Institute  
Spain

“**T**oday the European poultry industry has three concerns — food safety, food safety and food safety,” Brufau said.

Toward that end, regulatory agencies will ban all antibiotic growth promoters by next year, and in-feed anticoccidials are up for review in 2008. While these actions might give consumers a more favorable view of meat production, they will also increase costs for producers and force them to become better managers.

The drug bans will also place more emphasis on nutrition, vaccination and alternative therapies for managing coccidiosis, enteritis and other common diseases.

For this reason, Brufau and his associate, Dr. Maria Francesch, explained, the “D” in the IDEA concept stands for more than *digestibility*. “It also stands for *development* of intestinal integrity and *defense* through better management of the immune system,” he said.

“If the ingredient has a perfect digestibility, that means it does not have anything that impairs absorption of the nutrients of the ingredient. The animal has more energy to build immunity to disease and more energy to react to and create the ideal conditions needed for vaccines.

“These are the challenges we face as more drugs are taken off the market. We need to focus more on nutrition, particularly during the first 15 to 20 days of the bird’s life,” he added.

“It’s like the construction business. If you want to build a big house, you need to construct a big basement. I



think birds in a good management system can be raised without antibiotics and still maintain the same level of performance, but we need to pay more attention to details and do all we can to develop good intestinal health early in the bird’s life.”

Brufau said coccidiosis vaccination is and will become an even more important tool to keep *Eimeria* resistance as low as possible. Increasing the digestibility of feed in vaccinated broilers may reduce negative side effects generated by *Clostridium perfringens* and other enteric pathogens.

Feeding programs and feed composition can have a significant impact on a bird’s ability to fight intestinal disease, especially when antibiotic growth promoters are not used. This is particularly true in Europe, he added, where producers routinely feed coarse grains containing soluble non-starch-polysaccharides.

Soluble NSP ( $\beta$ -glucans and arabi-

noxylans) can increase digesta viscosity and reduce nutrient digestibility (particularly fat) by altering intestinal microflora. Studies conducted by IRTA and Schering-Plough Animal Health show that using NSP-degrading enzymes, alone or with antibiotic

growth promoters, can increase dietary protein and lipid digestibility in diets with wheat, barley and rye. Enzymes can also enhance villi length and thickness.

## ECONOMIC: An accounting of broiler energy expenditure



*Dr. Robert Teeter  
Oklahoma State University  
Stillwater*

**B**roiler growth is influenced by numerous dietary factors, such as protein quality and the amount of nutrients and calories the ration provides. For optimum performance and efficiency, it's important to maintain optimal calorie/nutrient ratios and accurately rank feedstuffs and feed additives by their impact on energy-nutrient utilization. Producers also must consider the flock's environment and how it impacts energy expenditure,

nutrient need and ultimately intestinal health.

The single largest nutritional factor affecting feed efficiency is the energy level of the feed. Though birds have some capacity to adjust for caloric density, the added energy expenditure linked to feed consumption is costly and can reduce dietary caloric value considerably. Dietary energy utilization by birds depends on ingredient digestibility, as well as its efficiency of conversion into maintenance and productive functions.

"Nutritionists must continually strive to 'correct' the metabolic energy (ME) values so they're in line with actual energy utilized by the bird in their particular environment," Teeter said. These adjustments hinge on both nutritional and non-nutritional factors that affect the birds' environment, feed intake and energy utilization.

A new method called Effective Caloric Value (ECV), developed by OSU, helps producers assess the non-nutritional factors. These include:

- **Net energy** — Energy used for maintenance and productions
- **Basal metabolism** — Heat production of an animal at rest, awake, fasted and housed
- **Maintenance energy needs** — Net energy consumed for maintaining body functions, acquiring needed

nutrients, generating immunological response and so on.

- **Protein and fat accretion** — The amount of feed energy required to obtain a defined tissue increment
- **Nutrition partitioning** — Includes feed restriction, ration composition, dietary fat supplementation, rearing temperature, genotype and lighting, which affect protein and fat accretion
- **Thermoneutral environment** — The combination of ambient temperature, relative humidity, wind, precipitation, photoperiod, solar radiation intensity and cloud cover
- **Microbial—host interactions** — Microbial effects can be both beneficial (vitamin synthesis, toxin destruction, etc.) and detrimental (toxin production, infection, nutrient destruction, energy wasting)

“The ECV system enables seemingly disjointed processes that influence performance to be related via a common performance-based reference standard,” Teeter explained.

“Factors such as lighting, feed form, ration composition, stocking density, waterer or feeder space and overall production systems are all related. Indeed, interacting variables — such as fat addition to elevate caloric density versus deterioration of pellet quality due to fat addition — may be added up so the appropriate course of action can be taken for maximal efficiency. Final bird performance is interactive with stress combinations, the ability of the bird to sustain appetite and its metabolic profile.”

Recognizing the trend toward coccidiosis vaccination, Teeter reported results of energy studies comparing vaccinated birds with flocks on various shuttle programs using in-feed anticoccidials.

“By itself, coccidiosis challenge has a potentially high cost — up to 600 kcal

— unless countered with drugs or vaccines,” he reported.

In studies at OSU, vaccination reduced that cost in production environments — saving 150 to 260 kcal over drugs and 400 kcal versus the coccidiosis challenge itself.

During the first 2 weeks of life, the energy cost of vaccinated birds was approximately 47 kcal to attain presumed protection, he reported. When examined to 44 days, the energy cost was 114 Kcal. “The cost appears nominal, yet the final production cost will be determined interactively with bird appetite,” Teeter said.

*Teeter: The single largest nutritional factor affecting feed efficiency is the energy level of the feed.*

“When we give a vaccination, what are some of the subtle types of changes that we would need to make in terms of management and nutrition to help the bird through this phase?” Teeter asked. “It ranges between 40 kcal or so to as much as 112 kcals, which is not much in a bird that’s consuming 15,000 kcals at capitalization for market. Those costs are trivial.”

The key issue, he added, is to maintain feed intake in these birds. The caloric cost of developing immunity is small, and Teeter views that as being added into a maintenance requirement. “If we can maintain feed intake, we’ll be able to attain a performance throughout the life cycle of these birds,” he said.

Teeter said behavioral changes take place in vaccinated birds, similar to what would be seen in a disease outbreak because their immune system is being stimulated with a controlled dose of a pathogen.

“Any bird that’s eliciting immunological response will back off feed just a tad,” he said. “And when that happens, they’ll gain a bit less weight and give off more energy as heat. But this is happening *early* in the production cycle. If you can adjust the feed accordingly in the first 21 days, then you have a bird that’s set up for excellent performance later in life. They’re more resilient; they’re able to handle various types of cocci challenges from the diet, and go on and produce product in a very efficacious type of manner. A bird toward the end of its growing period cycle has a body weight gain up

around 90 to 115 grams a day, so there’s great potential to make up any differences that are lost early.”

Teeter noted that even when drugs employed, nutritionists talk about “leakage.”

“But we don’t want to give them so much drug that they don’t become immune, because there we’re trying to get the birds to become immune as well,” he said. “Otherwise we are delaying that process and we’re setting ourselves up for outbreaks in the grower period, which can be much more costly.”

## Optimizing broiler nutrition programs



*Dr. José Ignacio Barragán  
Nutritional Consultant  
Spain*

**B**arragán review the principles of broiler nutrition, noting that there was a direct relationship between metabolized energy (ME) and the feed conversion ratio (FCR) and, to a lesser extent, the average daily gain (ADG).

“The higher the ME, the better the FCR and ADG — or at least that’s what we want to believe,” he said. “And we know that the ME/crude protein (CP) relationship determines carcass quality.”

What happens in the field is sometimes a different story, however. While it’s true that higher ME levels always achieve lower FCRs — a variable also influenced by final mortality percentage, days of feeding and pellet quality — this difference is not so obvious for ADG, which is affected by management conditions, environmental quality and the intestinal health of the birds.

“On the other hand, intestinal health depends more on quality and digestibility of raw materials in the feed, rather than the classical nutritional levels,” Barragán said.

“A concentrated formula often lowers the digestibility. So for me, it is much more important to look for excellent digestibility of the raw materials of the feed than to look at its concentration. Many times it is possible to reduce concentration and obtain very good results because, with this reduction in concentration, we can improve digestibility, and the total performance could be better.”

Barragán presented data showing how the almost parallel lines between feed consumption and growth rate split around day 15 and continue to grow farther apart as birds mature. The economic loss from diseased or dead birds also increases markedly with bird age. Each point of mortality in the final days is equivalent to 1% higher FCR (approximately 20 grams or 0.045 lb).

“Mortality’s effect on cost is progressive, increasing toward the last days of the growing period,” Barragan said. “Our goal, therefore, must be to reduce final mortality through optimization of the immune system, sanitation, vaccination and control of metabolic mortality.”

The IDEA concept can help reduce mortality by employing a special starter feed to help improve the immune status of the birds and reduce final mortality due to mild coccidiosis. Increasing digestibility in the middle of the fattening period also could reduce metabolic deaths.

As a general rule, the greater the ADG, the better the FCR. Still, ADG is more affected by management, environmental factors, disease and other variables, he said. The IDEA concept can help maximize ADG by optimizing growth in the first weeks, helping broilers develop a beneficial gut microbiota, reducing intestinal disorders in the middle of the fattening period, lowering clostridium risk and reducing mild coccidiosis outbreaks.

Barragán cautioned against depending on crude protein to optimize ADG. “An increase in protein level may be useful in carcass quality, but an increase in protein or amino acid levels is not clearly related to an increase in ADG,” he added. “However, the availability of digestible protein is closely related to growth and intestinal health. It may be possible to obtain better performance with less concentrated feeds made with quality ingredients.”

The nutritionist presented data showing that birds with the low-



density starter diet have the same result as birds with more concentrated ones — possibly because of better digestibility. He also showed that birds vaccinated for coccidiosis can be placed on a lower-cost withdrawal feed earlier than medicated birds without significantly affecting performance and without problems related to in-feed anticoccidials.

*Barragán: Our goal must be to reduce final mortality through optimization of the immune system, sanitation, vaccination and control of metabolic mortality.*

In Barragán’s comparative trials of a feeding regimen based on IDEA’s three-feed concept, which included organic acid, the cost was €10.73 more than the standard three-phase feed cost for the medicated birds. However, the vaccinated birds on the IDEA regimen produced €19.68 more meat value. A four-phase IDEA diet increased feed cost by €2.91 but meat value was €6.32 greater.

“When we slaughter animals at a bigger weight, perhaps 2.5 kg (5.51 lbs), it could be possible to use just three feeds,” he says. “But if you need to slaughter some of your animals at a low weight, at around 36-37 days, it could be necessary to use the four feeds to look for the optimum weight in the younger birds.”

Increasing ADG by 1 gram (0.002 lb) per day could mean a maximum reduction in FCR of 70 grams (0.154 lb), which is equivalent to 3.5% of feed-

ing cost reduction, Barragán said. Reducing mortality by 1% can lower FCR approximately 20 grams (0.045 lb), which is the same as 1% of reduction in feed cost.

“With IDEA, it’s possible to use a low-cost withdrawal feed for a longer period if intestinal health is correct and coccidiosis is not a risk, which is always the case when birds are vaccinated,” Barragán said. “Vaccinating for coccidiosis also can help us obtain better production costs and profitability.”

## ADVANCE: Putting IDEA into action



*Dr. César Carnicer  
Poultry Business Manager  
Spain*

**C**arnicer insisted that he’s not the “father” of the IDEA concept, but he can vividly remember when it was born.

He was meeting with nutritional consultant Dr. José Barragán (see

above report) and Dr. Delair Bolis, a Schering-Plough Animal Health veterinarian, and discussing ways to ensure success with coccidiosis vaccination, particularly as it related to nutrition.

Bolis presented his ideas for the ideal nutritional status of birds vaccinated for coccidiosis. Barragán named the first stage of the feed program “impulse,” where the strategy is to stimulate the immunity of the birds. The group then talked about a second phase where the focus was on “digestibility.” That led to a discussion about the “economic” benefits and how a such a program could help producers “advance” their efforts to meet regulatory and consumer demand for drug-free approaches to disease management.

“We reviewed our notes from the meeting and the key points were Impulse, Digestibility, Economic, Advance — or IDEA,” Carnicer said. Schering-Plough Animal Health’s management and global technical service team embraced the concept and then worked with nutritionists worldwide to fine tune the basic elements of the



“intestinal health” strategy. According to Carnicer, poultry companies are reacting favorably.

“I don’t think we’ll have companies saying, ‘I’m going to do the IDEA program,’ but they are taking our inputs and are applying the principles of IDEA to their own situation,” he said. “IDEA is not a fixed scheme. It’s a bank of knowledge, and each poultry company will adapt it to suit its needs. But it’s clear they are being more proactive with nutrition to ensure a healthy gut instead of relying on drugs.”

Carnicer says coccidiosis vaccination is not a prerequisite for applying the IDEA concept, as its principles can benefit virtually any operation. It is easier to use with vaccinated birds, however, because producers will have more flexibility when there are no anticoccidials in the feed. More important, he added, poultry companies are now designing programs with vaccinated birds in mind — the same way they built programs around anticoccidial drugs.

“Poultry companies like the IDEA concept — not just because it will save them money and help them eliminate drugs, but because it is improving their overall management,” Carnicer said. “They no longer have drugs to mask their problems, so they can see areas for improvement and work with nutritionists and other consultants to make adjustments to the birds’ feed and other factors that will stimulate immune response.”

He reported that the IDEA concept is also helping poultry companies be more flexible with marketing. “The need for a withdrawal feed no longer exists, because you are not using a feed medication for coccidiosis control,” he said. Eliminating in-feed anticoccidials also lets producers “thin out” their flocks and sell lighter birds upon demand. Feed mill personnel say they like not having to flush the feed lines to avoid drug residues.

As the IDEA concept takes hold, Carnicer said poultry companies were moving away from standard three-phase programs build around shuttle programs or drug-withdrawal times (e.g., 0-21 days, 22-40 days, 41+ days) to schedules that better meet the nutritional needs of the birds (e.g., 0-14 days, 14-28 days, 28+ days).

*Carnicer: Poultry companies like the IDEA concept — not just because it will save them money and help them eliminate drugs, but because it is improving their overall management.*

“As a general rule, IDEA requires making a higher investment in quality, digestible feeds in the first 25 to 28 days and then a lower investment in the final phase when birds are consuming the most feed,” he said. “Producers are finding that focusing on immunity development, digestibility of the feed and intestinal integrity is more important than nutrient levels.”



## Experience in Italy

*Dr. Corrado Longoni*

*Martini Alimentare*

*Italy*

**L**ongoni, a veterinarian for a major poultry company in Italy, cited five reasons for eliminating in-

feed anticoccidials and making vaccination against coccidiosis the only method for managing the disease:

- One-shot administration for lifelong control of coccidiosis (no late outbreaks)
- Zero withdrawal times, which gives his company great flexibility for marketing lightweight birds and simplifying procedures at the feed mill
- Opportunity to market poultry meat with additional quality guarantees (e.g., no risk of drug residues)
- No risk of contaminating feed for other types of birds or other species
- Restoration of sensitivity to worn-out, in-feed anticoccidials

*For a more in-depth report of how Martini Alimentare is using the IDEA concept in its production program, see article on page 6.*



## Experience in the United States

*Dr. John Halley*

*Cobb-Vantress*

*United States*

**H**alley, a nutritionist, discussed his experience with coccidiosis vaccination while he was a nutritionist for one of the largest poultry companies in the US.

“The motivation for our use of Coccivac was probably a little different than it would be today,” he said “This was 5 years ago and, at the time, most companies in the US used roxarsone along with ionophores to give better coccidiosis control.”

The poultry company produced large birds — generally 3 to 3.5 kg (6.61 to 7.72 lbs) — all for deboning.



“One of the problems we had in the summer is we started to see ruptured tendons in these large birds. We wanted to get to a program where we could take the roxarsone out of the feed but still have good coccidiosis control.”

The company started vaccinating with Coccivac-B in one complex to see how it would work, starting late in the spring and running through the summer to get all the birds through the heat of the summer. Then the company would go back to its regular program in the fall, which was salinomycin and roxarsone.

The company expected to lose some feed conversion and daily gain after switching to vaccination, but figured it would make up for any losses after going to the well-tested drugs and getting better performance from these medications.

“But as we went on to the Coccivac-B in the first complex, we didn’t see any loss in performance,” Halley reported. “Performance stayed the same as far as weight gain, feed conversion, and that particular complex went through three complete cycles that summer on Coccivac-B.

“What we found was that performance got better with each successive cycle. We got better feed conversion and picked up one or two points feed conversion.”

When the company went back to salinomycin, it didn’t see this big kick that other companies talked about.

“But then, we didn’t lose the performance going onto the vaccine, either,” Halley said. “So over the next 4 or 5 years we went ahead and put four or five other complexes onto this program, running Coccivac during the summer.”

At any one time, the company was processing 3 million to 3.5 million birds a week on this program and all complexes, whether they were in the deep South in the United States or in the

mid-South, up in the North Carolina region, saw similar results.

“We didn’t lose performance when we went on the vaccine, but with each successive cycle we actually picked up a little bit of feed conversion at the same body weights, and therefore we improved our cost and our production economics,” he explains. “We actually had one complex that wanted to use it year-round.”

*Halley: What we found was that performance got better with each successive cycle. We got better feed conversion and picked up one or two points feed conversion.*

From a logistics standpoint, the company’s feed mills didn’t have any problem with incorporating the vaccine into their program. Halley said they paid close attention to what they were delivering and where during the transition periods. “That’s important because accidentally putting an ionophore or chemical in the feed will kill the vaccine. Likewise, if you don’t medicate the birds that are supposed to get medicated, they’ll run into problems as well.”



At 14 days of age, or 6 days after the challenge, they necropsied five birds from Groups 1, 2 and 3 to determine individual coccidial lesion scores. They also counted per gram the number of oocysts in fresh feces, weighed birds periodically and observed them throughout the study.

### Anticoccidial sensitivity profile

The anticoccidial sensitivity profile for each *Eimeria* isolate was based on the percentage reduction of the median lesion score for each *Eimeria* type as compared to the infected, treated group (Group 3). A reduction of 0% to 30% indicated coccidial resistance, 31% to 49% indicated reduced sensitivity or partial resistance and 50% or more indicated full sensitivity to the anticoccidial, the investigators say.

There was significant resistance to both anticoccidials (Table 1), especially *E. acervulina*. Of these isolates, 70% were resistance to diclazuril and 55% were resistance to monensin, say Landman and Peek.

“The findings of this study show that resistance is still widespread

among European coccidiosis field isolates,” the investigators conclude.

### Role of vaccination

The investigators also discovered that vaccination appeared to affect sensitivity.

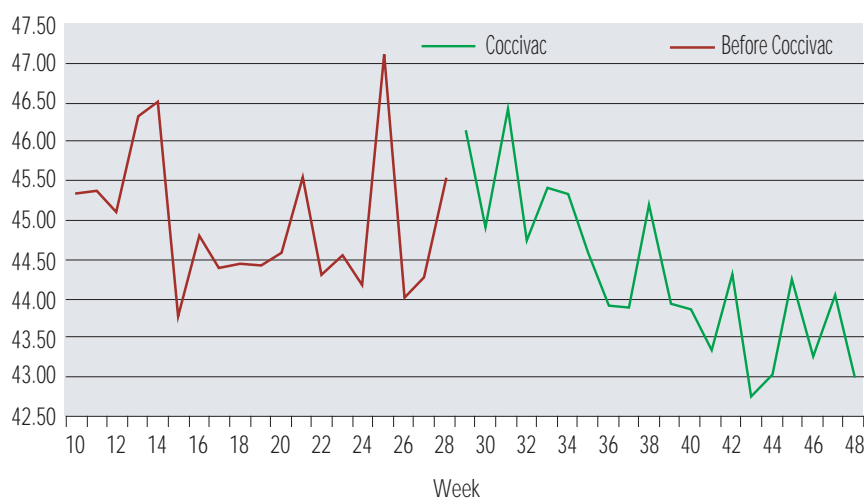
“Furthermore, our findings suggest that sensitivity toward both anticoccidial drugs tested occurs more frequently in *Eimeria* spp. field isolates originating from broiler farms where a coccidiosis vaccination policy is followed,” they say.

Table 2 summarizes the *Eimeria* species that were sensitive to diclazuril or monensin and the number of them that came from farms that had or had not vaccinated.

Landman and Peek are further studying the effects of vaccination on *Eimeria* sensitivity with larger numbers of birds. It is always possible that the findings might change, says Landman, but the results of the just completed study “very strongly suggest” that vaccination does, indeed, restore *Eimeria* sensitivity to both anticoccidials tested.

continued from page 9

Figure 5. Days to 5.0 lbs (before and after transition to Coccivac-B).



“We expect long term performance with Coccivac-B to improve further with annual vaccination, since it renews sensitivity of the house coccidial population to anticoccidials,” Newman says.

“Our actual overall 2004 performance numbers have improved compared to 2003, echoing the industry performance improvements,” she says. “As the industry improves its performance year after year, Coccivac-B performance remains in step. Coccivac-B provides a highly competitive alternative to in-feed anticoccidials with the added advantage of enhancing *Eimeria* sensitivity to all control methods.”

## Going drug-free

Martini began vaccinating a portion of its broilers in 2000, when Paracox-5 was approved for use in Europe. The company was confident it would be a good product because it had success with Paracox-8 in breeders.

“But broilers are different and, obviously, have a much shorter life cycle,” Longoni says. “We wanted to experiment with it first.”

What started as a few experimental trials gradually spread to entire farms. As the company obtained more experience with the product under different conditions, it extended usage to other farms.

“We had to manage a few coccidiosis outbreaks in the beginning, but those disappeared in the second flock,” Longoni recalls. “In fact, we found that the vaccine and the birds performed better with each successive flock.”

By 2003, Martini was vaccinating all of its broilers with Paracox-5, thus eliminating all in-feed anticoccidials from its program. The antibiotic growth promoter avilomycin is the only medication used today in broilers, but Martini expects to eliminate all drugs as more feed medications are removed from the market.

## Focusing on management

Between vaccinating for coccidiosis and getting ready for the expected ban on all feed medications, Martini is focusing more on good management and looking for ways to naturally improve the immunity of the birds.

“All our efforts are devoted to young chicken management, especially during the brooding period,” Longoni says. “We pay particular attention to what we offer them as a daily feed, and our nutritionist is constantly looking at new formulas and possible alternatives to antibiotic growth promoters.”

After Martini stopped using ionophores, there was some concern that necrotic enteritis might become more prevalent, but the company has not seen any significant problems.

“We know that ionophores are very effective against enteritis, but we can’t use them in our system,” Vandi says. “Our goal is to manage the problem in a nutritional way, using a less concentrated feed in the first phase to cause less stress on the intestines and have compensatory growth in the second period.”

For example: With animal proteins not permitted in European feeds, soybean meal is the only protein source available. “The key is to use a high quality soybean meal,” Amedei says. “If you don’t, you have to reach an inclusion rate in the starter diet of 40% or more, which is concentrated but not very digestible.”

Since switching to coccidiosis vaccination, Martini is now in a better position to build its feed program around the nutritional needs of the birds — not the withdrawal times of the medications. That might allow Martini to start feeding lower cost withdrawal feeds at an earlier phase.

“We are also assessing feed distribution, room temperature and humidity, ventilation, lighting, type and quality of litter, and the water supply,” Longoni reports.

“Our goal is to make young chickens as strong as possible with a robust immunity that can fight stress and allow them to reach their full genetic potential — without having to rely on drugs.”



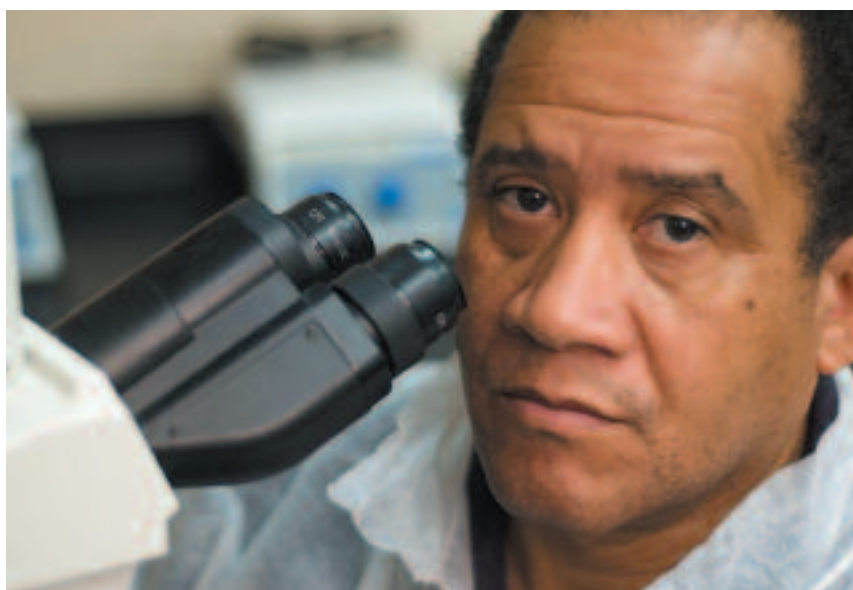
Vandi: ‘Manage the problem in a nutritional way’

## SOLVING THE *E. MIVATI* MYSTERY

Recent research, testing indicate the once elusive coccidial pathogen is a distinct species

For decades, *Eimeria mivati* — one of nine species of *Eimeria* known to cause coccidiosis in chickens — has been a source of controversy among poultry pathologists.

Some believed it to be a distinct *Eimeria* species that posed a threat to



Fitz-Coy: *E. mivati* oocysts tend to be smaller and broadly ovoid...

broilers, but others have been doubtful and consider it either a variant of *E. acervulina* or a mixture of the *E. acervulina* and *E. mitis* species.

However, recent studies, conducted by Dr. Steve Fitz-Coy of Schering-Plough Animal Health Corporation, as well as polymerase chain reaction testing, indicate that *E. mivati* is a unique type of *Eimeria*.

Studies also show that the prevalence of *E. mivati*, based on litter sampling, may be as high as 22% and that it causes disease and performance loss in chickens if not controlled.

### Putting it in perspective

“For a long time, the issue of *E. mivati* was not a major concern because anticoccidials were effectively controlling the primary pathogenic species of *Eimeria* that threaten commercial chickens,” says Dr. Rick Phillips, a veterinarian at Schering-Plough Animal Health Corporation.

“Any controversy about whether *E. mivati* is a distinct species was primarily one of academic interest, but it had little practical relevance,” he says.

Now, the situation is different, he says.

With the shift from in-feed anticoccidials to vaccination of chickens for coccidiosis control, *E. mivati* has to be considered. Anticoccidials control coccidiosis by killing parasites, but vaccines work by enabling chickens to build immunity that naturally fights off the disease, Phillips explains.

“Producers need to be sure that the coccidiosis vaccine they use protects against the major *Eimeria* species that cause disease in chickens, including *E. mivati*,” he says.

Keep in mind, Phillips continues, that there is no cross-protection when it comes to *Eimeria*, he says. “If chickens are immune to *E. acervulina*, they only have immunity against *E. acervulina* and, if exposed to *E. mivati*, they’ll succumb to the new infection. “Immunity against one species doesn’t protect against another,” he says.

### *E. mivati* history

*E. mivati* was first isolated in 1959 from a poultry farm in Zephyr Hill, Florida, by the late Dr. S. Allen Edgar, a world renowned poultry pathologist from

Alabama's Auburn University. Prior to recognition of the parasite, the farm had experienced persistent and unusual outbreaks of coccidiosis.

For several years after his discovery, Edgar conducted extensive research to determine the characteristics of *E. mivati* and validated its differences from other chicken coccidia.

In 1964, *E. mivati* was added to the list of coccidia affecting chickens when Edgar published his findings.<sup>1</sup> Subsequently, several researchers reported finding *E. mivati* in other countries, including Canada, Great Britain, Germany and France.

By the 1970s, however, some researchers began to question the existence of *E. mivati*.

In 1973, P.L. Long of Houghton Poultry Research Station (now the Institute for Animal Health), Huntingdon, England, concluded that *E. mivati* was not sufficiently different from *E. acervulina* to be a distinct species and that it should be referred to as *E. acervulina* var. *mivati*.<sup>2</sup>

Fitz-Coy, a parasitologist who worked with Edgar, says that the most influential report questioning the existence of *E. mivati* appeared in 1983, after Dr. Martin W. Shirley and associates, also of Houghton Poultry Research Station, used electrophoresis to study a potential field isolate of *E. mivati* provided by Auburn University.<sup>3</sup>

"They concluded that it was probably a combination of *E. acervulina* and *E. mitis* and should be considered "*nomina dubia*" — in other words, its existence is doubtful," he says.

The conclusions of that report stuck and, long after it was published, many researchers continued to question the validity of *E. mivati* as a unique species, says Fitz-Coy, now a technical service representative for Schering-Plough Animal Health. In subsequent years, while anticoccidials were effectively controlling coccidiosis, *E. mivati* received little attention as a research

infectious agent; it just wasn't much of a concern or it was lumped into an *E. acervulina*-like category.

In addition, says Fitz-Coy, *E. mivati* isn't as easy to work with as other coccidial species such as *E. acervulina*, *E. maxima* and *E. tenella*. The lesions of *E. acervulina* and *E. mivati* are similar and both "parasitize" some of the same regions of the intestines. Most field isolates are a composition of multiple species of *Eimeria*. "All these factors contribute to the difficulty in identifying *E. mivati*," he says.

There are differences, however. "Traditionally, identification of coccidia species is based on morphology, pathology, the prepatent period and cross-immunization evaluations. *E. mivati* oocysts tend to be smaller and are broadly ovoid compared with those of *E. acervulina*," he says.

*The current prevalence is probably underestimated because E. mivati is under-recognized, and even a 20% incidence is pretty significant.*

### Further research

Not widely known is that Fitz-Coy continued research with *E. mivati*, though his findings were not always published.

Between 1988 and 1990, when Fitz-Coy worked for the University of Maryland, Eastern Shore, he isolated three probable isolates of *E. mivati*. They were obtained from commercial broiler farms in the Delmarva region of the United States. All three had similarities to the *E. mivati* described by Edgar, his mentor.

When Fitz-Coy immunized chickens with *E. acervulina* and challenged them with the *E. mivati* he had isolated, the birds had no protection and developed coccidiosis. But when he immunized chickens with the *E. mivati* and chal-

lenged them with *E. mivati*, they had good protection.

### PCR testing

According to Phillips, the most compelling evidence that *E. mivati* is a distinct species comes from recent PCR testing, a sensitive, state-of-the-art technique that enables identification of small DNA fragments.

Current PCR kits identify *E. acervulina*, *E. maxima*, *E. necatrix*, *E. mitis*, *E. brunetti* and *E. tenella*. When Fitz-Coy provided blind or unidentified samples of *E. mivati* and other species to a research investigator for PCR testing, the known species were identified, but the *E. mivati* samples could not be identified.

Fitz-Coy plans to publish his findings with details, and an *E. mivati* PCR-primer is currently being developed for rapid identification purposes.



Phillips: 'The current prevalence is probably underestimated...'

### Prevalence

For producers, the real significance of *E. mivati*, Phillips points out, is its prevalence in the field and its affect on flock performance.

In the early 1960s, Edgar had found a 50% incidence of *E. mivati* organisms in samples sent to Auburn from Florida.

Fitz-Coy says, "Based on my observations over the years, study of field isolates and routine necropsy evaluations of chickens from commercial broilers farms in the Atlantic,

Southeast and West Coast, organisms that morphologically resemble those of *E. mivati* are seen. They can appear in

great abundance and are found throughout the entire small intestine."

From 2001 to 2004, Fitz-Coy analyzed data from approximately 130 necropsy sessions in the United States, and found 24 were positive for *E. mivati*. In other words, 18% of the necropsy cases were positive for *E. mivati*. Between 2002 and 2004, when he tested 55 litter samples from major US broiler production areas, 12 were positive for *E. mivati*, yielding a 22% incidence, he says.

Phillips says, "The current prevalence is probably underestimated because *E. mivati* is under-recognized, and even a 20% incidence is pretty significant."

### Impaired weight gain, mortality

The consequences of *E. mivati* infection in chickens were evaluated by Edgar from the 1960s to 1980s and by Fitz-Coy since the late 1980s. Three of several *E. mivati* field isolates from Georgia and the Delmarva area were used. For each evaluator, groups of birds were inoculated with varying amounts of *E. mivati* oocysts to evaluate for growth rate and mortality, and one group was not inoculated and served as a control.

The more *E. mivati* oocysts that birds received, the worse the outcome. For instance, 14 days after challenge, birds that received the most oocysts had an average weight gain per bird of 110g (0.24 lb) compared to 271g (0.60 lb) in controls.

None of the birds in the control group died, but in the group that received the strongest challenge, 10% died (see Table 1).

In a subsequent study conducted by Fitz-Coy, inoculation of naïve birds using an *E. mivati* isolate from North Carolina yielded a mortality of 50%. There was no pathology in hatch mates immunized with *E. mivati* against the isolate.



## Pathologic changes

Another way to demonstrate the pathogenicity of *E. mivati* is by examining the pathologic changes it causes in chickens. *E. mivati* oocysts, says Fitz-Coy, usually are found in intestines that have been scored with mucoid and/or watery enteritis. They are smaller oocysts than those of *E. acervulina*, and are broadly ovoid.

As far back a 1980, researchers Norton and Joyner wrote in *Parasitology* that they had found “clear distinctions” between the damage done by *E. mivati* and *E. acervulina* isolates.<sup>4</sup> *E. mivati* produced scattered petechiae (red spots), but the intestinal lesions were not as prominent compared to those seen with *E. acervulina*. The manifestations of *E. mivati* were most numerous in the lower small intestine and proximal ceca.

In addition, the ratio of villus height to total mucosal thickness in the lower intestine was reduced with *E. mivati*, while similar changes due to *E. acervulina* were seen only in the anterior intestine, Norton and Joyner said.

Fitz-Coy has no doubt that “*E. mivati* is pathogenic to chickens, resulting in impaired feed utilization, impaired growth and, sometimes, mortality depending on the level of challenge.”

Phillips agrees and says, “*E. mivati* is real. Be sure that the vaccine you are using to control coccidiosis protects against *E. mivati*. Coccivac-B has always contained *E. mivati* and, currently, is the only licensed commercial vaccine that protects against this *Eimeria* species.”

“We didn’t have to deal with *E. mivati* before because anticoccidials were controlling it, but it’s safe to assume that *E. mivati* resistance to

Table 1. Growth rate and mortality in birds challenged with *E. mivati*.

Treatments/oocysts inoculated per bird for challenge	Gain/bird at 7 days post challenge (g)	Gain/bird at 14 days post challenge (g)	% Mortality
None	137	271	0
750,000	48	155	0
5,000,000	-4	132	0
5,000,000 plus 5,000,000 at 2 days post challenge	-38	110	10

After Edgar 1964.

anticoccidials may be developing just as it has for other *Eimeria* species. On the plus side, we have an effective method of control,” he says.

Further PCR research is being aggressively pursued, Phillips adds. “Since *E. mivati* can affect poultry performance, we want to make sure that any questions about its existence are resolved once and for all. There’s also still a lot to learn about this *Eimeria* species,” he concludes.

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## Web Site Promotes Intestinal Health in Poultry

A new web site providing an informative source of information about maintaining intestinal health in poultry has been launched by Schering-Plough Animal Health.

The site, [www.intestinalhealthpoultry.com](http://www.intestinalhealthpoultry.com), provides visitors with an overview of the challenges facing poultry producers — specifically public concern about food safety and the problems with traditional coccidiosis control programs.

It offers solutions from Schering-Plough Animal Health and emphasizes the company's commitment to helping

producers meet demand for drug-free food production by improved management of intestinal health.

With sections in English and Spanish, the web site also provides an overview of Schering-Plough Animal Health's coccidiosis vaccines, as well as SprayCox administration equipment and the growth promoter, Enradin.

In time, visitors will also be able to access past issue of *CocciForum* magazine, as well as relevant key Technical Service Bulletins.



Townsend at the International Poultry Expo with the clear jug and new AirMix technology available for the SprayCox spray cabinet.

## AirMix Technology Debuts in Atlanta

Schering-Plough Animal Health's new AirMix technology for keeping coccidiosis vaccine oocysts in suspension during spray vaccination was unveiled at the International Poultry Expo in Atlanta.

"The response has been very positive," says company engineer Paul Townsend. "Basically, the first thing they notice is that you can actually see the vaccine in the bottle. You can see it being mixed — and that's a real positive. With the old system, the only way you could really tell if it was mixing was to remove the lid and looking down inside. So this makes it real foolproof. That's really the goal behind going to a system like this."

Upgrading existing SprayCox spray cabinets to AirMix technology is quick and easy. It's just a matter of changing out the container and putting on a new pump to supply air to the bottle, which plugs into the machine.

Townsend says the presence of air does not increase the chance for vaccine contamination. "We have a filter in the line to clean the air before it gets into the bottle," he explains. "We left nothing to chance."

Challenge work was conducted by Dr. Steve Fitz-Coy, a technical service rep for the company known worldwide for his expertise in coccidiosis. AirMix will be available in the US this spring and in other markets later this year.

## Proper Handling of Vaccine Essential for Good Results

Proper vaccine handling is crucial to obtain the best results with live oocyst vaccines such as Paracox and Coccivac, cautions Dr. Charlie Broussard, worldwide technical services director, Schering-Plough Animal Health.

The oocysts in the vaccine are sensitive to environmental temperature. The vaccine should be maintained between +2° C and +8° C (36°- 47° F) throughout shipping, storage

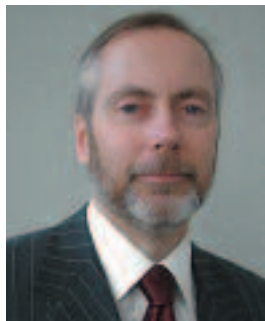
and subsequent transport to farm or hatchery, Broussard says.

"Watch out for uneven temperatures in a refrigerator that could result in partial freezing of the product, especially if it's kept near the top, bottom or back of the unit," he says.

"Even if you see just a few ice crystals in the liquid, toss the vial. Even partial freezing can destroy enough of the oocysts to impair vaccine efficacy," Broussard adds.

## Got a Story Idea for *CocciForum*?

The editors of *CocciForum* welcome news tips and story ideas from its readers around the world. If there's a particular subject you'd like to see covered in a future issue — perhaps a specific area of coccidiosis management — please let us know. Write to [JFeeks@prworks.net](mailto:JFeeks@prworks.net) or call 508-627-6949 (US). We want to hear from you.



## It's all about food safety

When looking over the articles for this issue of *CocciForum*, I was moved by Dr. Corrado Longoni's main reason for wanting to remove drugs from the poultry feeds used by his employer, Martini Alimentare, a major producer in Italy.

"I have two babies at home," he says in the article beginning on page 8. "When I go down to our company slaughterhouse to buy chicken for my family, I do it with confidence because I know our product is safe and free of drug residues. Food safety has to be our first priority — for us, for our customers and for the image of the poultry industry."

Over on page \_\_\_\_, in our special report about the global symposium we sponsored for nutritionists working to manage disease through better intestinal health, I was struck by Dr. Joaquim Brufau's list of the top three concerns in the European poultry industry: food safety, food safety and food safety.

### More drug bans coming

Later that same day, I reviewed a paper that my colleague, Dr. Fabio Paganini, prepared for the Seventeenth European Symposium on the Quality of Poultry Meat in the Netherlands this May. He noted the growing concerns from consumers and the medical community about antibiotic resistance in animals being passed along to humans. Even though this relationship has been a controversial issue, the use in animal feed in the European Union will be prohibited as of January 1, 2006. How long will it be before the US and other major markets do the same — if only to meet demands of export markets?

Then there are the ionophores, another type of feed antibiotic commonly used in poultry and livestock to manage coccidiosis. Paganini writes that the use of these in-feed anticoccidials in livestock does not appear to be related to the development of resistance in humans.

"However," he adds, "their toxicity to non-target species and the potential contamination of meat, animal feed and

the environment with residues have made a growing number of poultry producers discontinue their use in favor of drug-free alternatives such as vaccines.

"When vaccination is coupled with good management, particularly high quality nutrition, it greatly reduces or eliminates the need for drugs used to control coccidiosis as well as other conditions in birds. At the same time, it allows producers to be as cost-competitive as when using anticoccidials."

### There are alternatives

Schering-Plough Animal Health saw this trend coming in the 1990s and recognized the need for alternatives to coccidiosis management. That certainly gave us reason to speed development of our two lines of coccidiosis vaccines, Coccivac and Paracox, but we also saw an opportunity to help the poultry industry find drug-free alternatives without compromising performance, efficiency and profitability.

In time we recognized that there was more to managing coccidiosis in drug-free birds than swapping a medication for a vaccine. To make this work effectively, poultry companies also need to rethink their nutrition programs and focus on better intestinal health.

We are happy that we can share our expertise in this area — whether it's through an article in *CocciForum*, a visit to a customer or by hosting major seminars, such as the ones we held recently in Madeira (page6) and Atlanta at the International Poultry Expo.

More importantly, we are grateful for the many independent experts who have been working closely with us to develop the IDEA concept for better intestinal health. You can count on us to bring you more ideas and products for better intestinal health in the future.

Stephen P. Collins  
Vice President, Worldwide Poultry  
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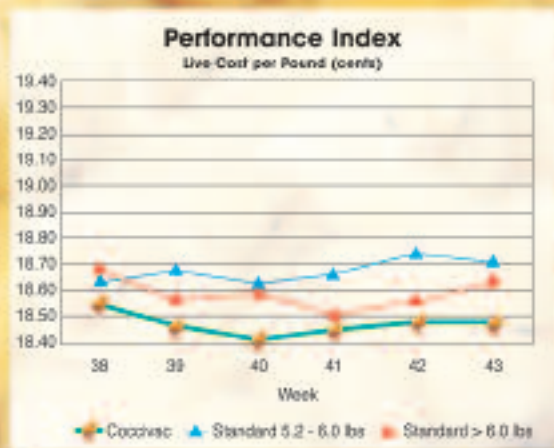
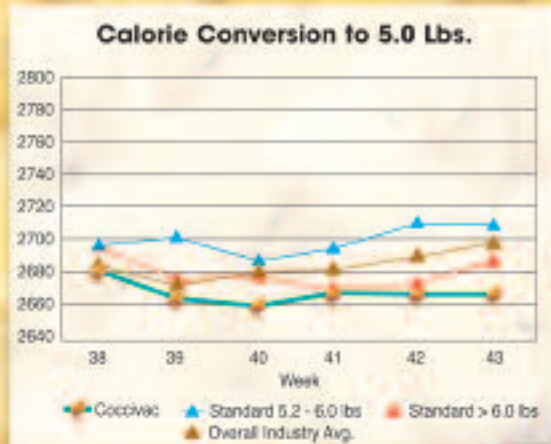
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