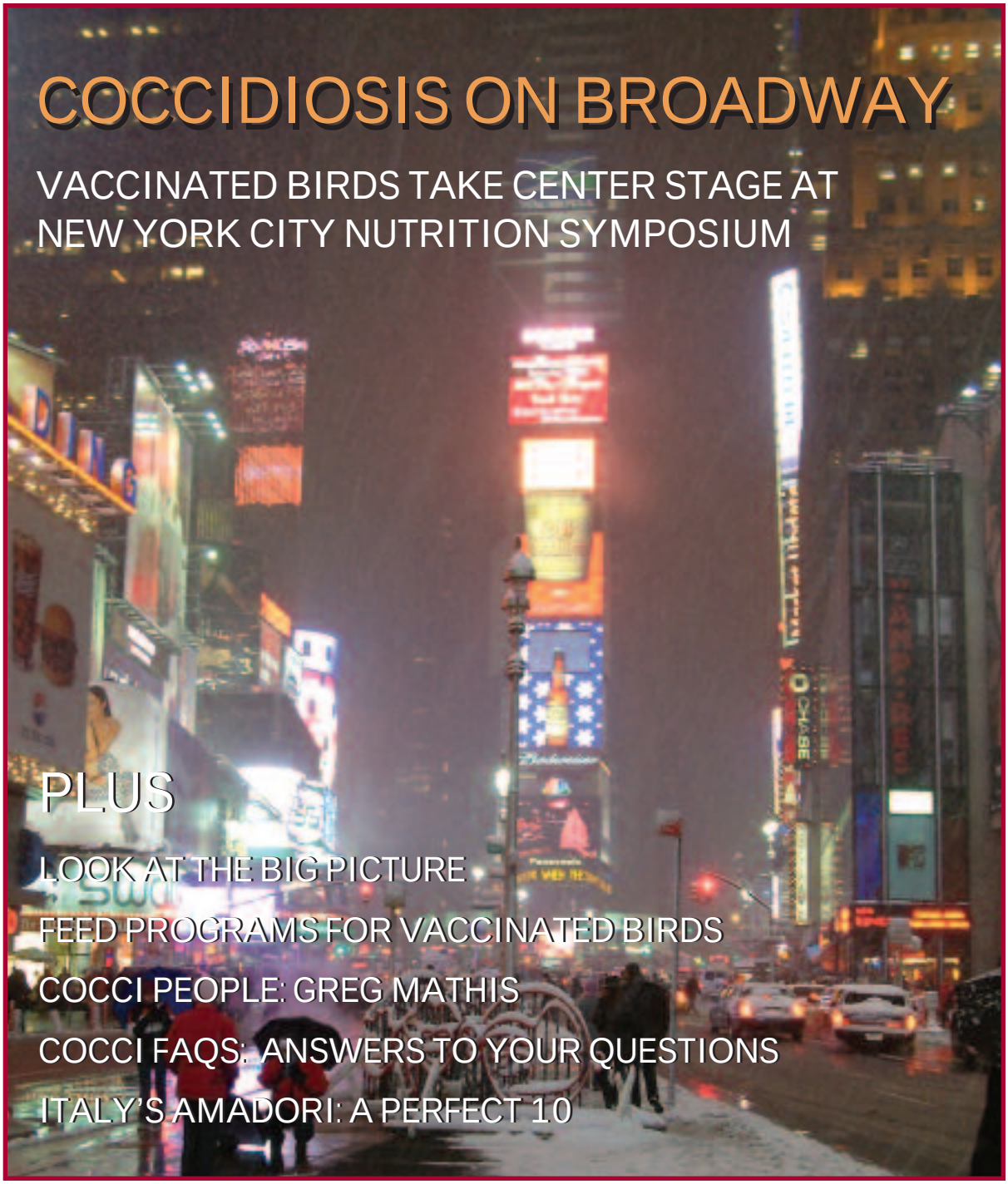
COCCI FORUM

NEW STRATEGIES FOR COCCIDIOSIS MANAGEMENT

SPECIAL DOUBLE ISSUE



COCCIDIOSIS ON BROADWAY

VACCINATED BIRDS TAKE CENTER STAGE AT NEW YORK CITY NUTRITION SYMPOSIUM

PLUS

LOOK AT THE BIG PICTURE

FEED PROGRAMS FOR VACCINATED BIRDS

COCCI PEOPLE: GREG MATHIS

COCCI FAQS: ANSWERS TO YOUR QUESTIONS

ITALY'S AMADORI: A PERFECT 10

SPAH-PBU-331

Schering-Plough Animal Health

NUMBER 8

Performance

Schering-Plough Animal Health

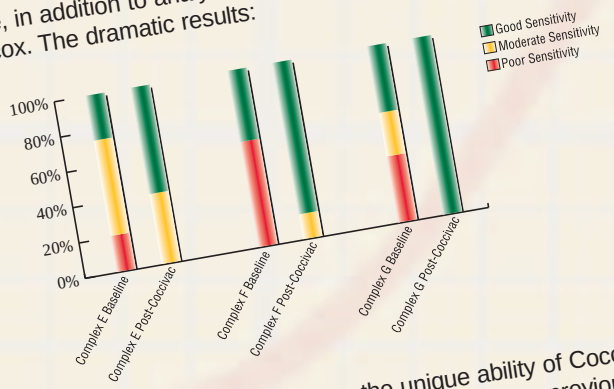
American Scientific Laboratories, Inc.

Dear Partner in Poultry Production:

Last year, while reporting on the success of Clinacox® (diclazuril), we reminded the industry to use this new-generation anticoccidial judiciously to minimize the development of resistance. We also mentioned having trials underway to help us formulate more precise recommendations for an integrated, multi-product anticoccidial program – one that would help restore the anticoccidial sensitivity of *Eimeria spp.* populations.

Working with a major US poultry company, we chose three complexes that had used Clinacox in either a continuous or shuttle program for at least one cycle during the prior year. Coccivac®-B – our live-oocyst coccidiosis vaccine that has been shown to seed houses with sensitive strains of *Eimeria* – was used for two full cycles.

We then compared the sensitivity of the field *Eimeria spp.* populations to Clinacox before and after Coccivac-B usage, in addition to analyzing and categorizing the sensitivity of the coccidial isolates to Clinacox. The dramatic results:



This study confirmed previous research showing the unique ability of Coccivac-B to restore the efficacy of in-feed anticoccidials – in this case, Clinacox. Based on previous field observations and this new information, we continue to recommend using **Clinacox** for only one cycle annually or in a shuttle program (starter or grower ration, but not both) in two sequential cycles. **Coccivac-B** can be used for two to three cycles in an annual rotational program with Clinacox.

For more information, please contact your rep or call us today at **1-800-219-9286**.

Sincerely,

Rick Phillips, DVM
Director, Poultry Technical Services

Schering-Plough Animal Health
EXPERTISE...COMMITMENT...VALUE

COCCI FORUM

NUMBER 8

FEATURES

Cover: This was the wintery scene in New York's Times Square after the December symposium on managing nutrition in birds vaccinated for coccidiosis. The surprise storm eventually dumped more than a foot of snow on the city — much to the amazement of the symposium's attendees, many of whom were from more temperate climates. See page 6 for the full report on the symposium.

Photo by Joseph Feeks.

LOOK AT THE BIG PICTURE

Industry performance data show birds vaccinated with Coccivac-B perform as well as or better than other programs

You're considering adding a coccidiosis vaccine to your management program, but you're wondering how broiler performance will stack up against other strategies you've used.

Wonder no more.

Now, performance data from an industry reporting service in the United States show that when growers include Coccivac-B in their programs, they can achieve results equal or superior to other strategies.

In the study, performance of birds vaccinated with Coccivac-B for coccidiosis was compared to birds of similar weight that used standard anticoccidial programs.

The study ran from week 29 (mid-July) to week 43 (early November). Each week or "data point" in the accompanying figures represents the average of 19 to 23 vaccinated complexes versus 28 to 30 complexes that used standard in-feed anticoccidial programs. For complexes that used Coccivac-B, mean bird weights were 6.0 lbs at week 29 to 38, and 6.3 lbs at weeks 38 to 43.

How do birds compare?

Investigators first looked at how the performance of birds compared during the summer months, focusing specifically on live cost per pound of meat as well as calorie conversion.

Birds that received Coccivac-B — even though they had an average weight of about 6 lbs — performed better than similar-weight birds using standard anticoccidials. That was true even for birds on standard anticoccidials that weighed 5.2 to 6.0 lbs or greater than 6 lbs.

During cooler fall weather, performance for all classes of birds picked up, partly due to reduced stress from the hot weather. Performance for birds that were vaccinated with Coccivac-B was, again, superior to the overall industry average.

Dr. Rick Phillips, director of worldwide poultry technical services for Schering-Plough Animal Health, says it's also important to keep in mind that

Figure 1. Calorie Conversion to 5.0 lbs, Summer.

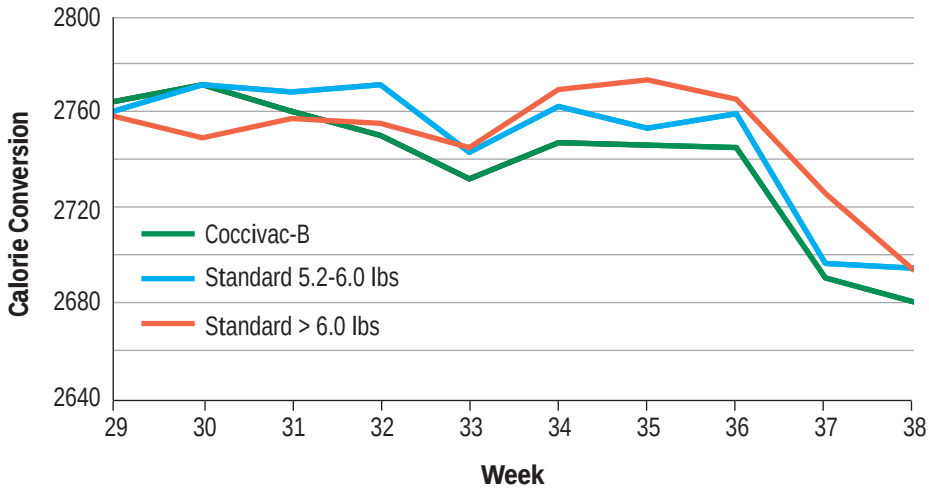


Figure 2. Days to 5.0 lbs, Summer.

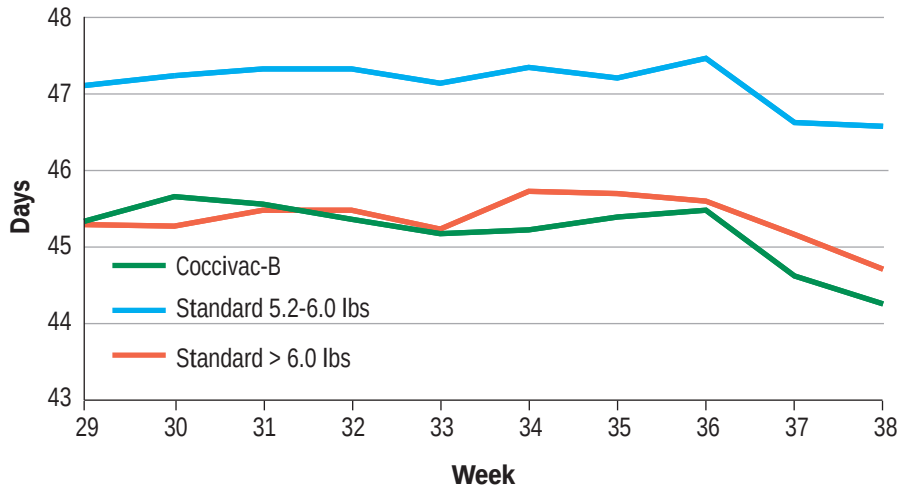


Figure 3. Calorie Conversion to 5.0 lbs, Fall.

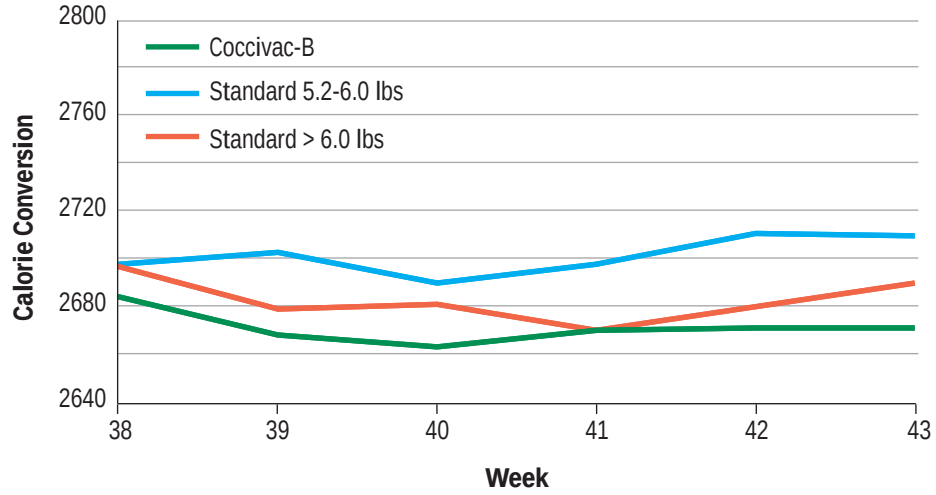
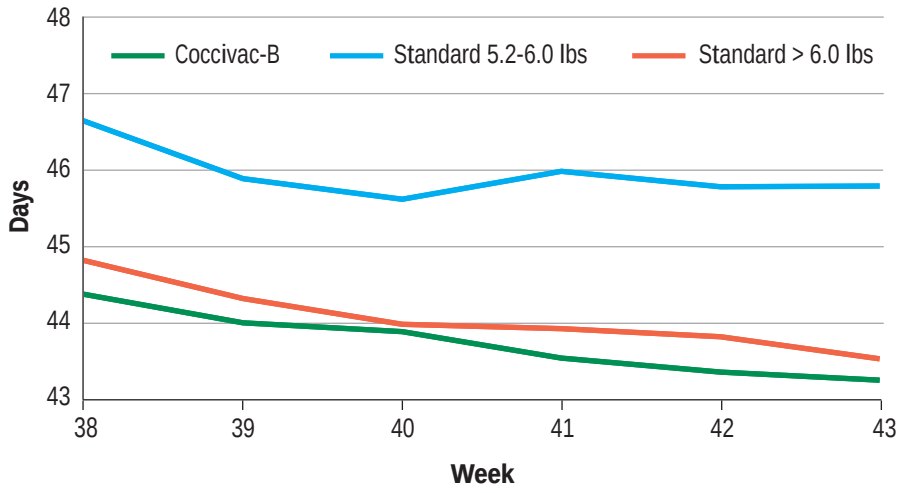


Figure 4. Days to 5.0 lbs, Fall.



hot weather continues to exert a major impact on performance, regardless of whether birds are vaccinated with Coccivac-B or on standard in-feed anticoccidials, or whether they are housed in traditional growing environments or housed in modern environmentally controlled houses.

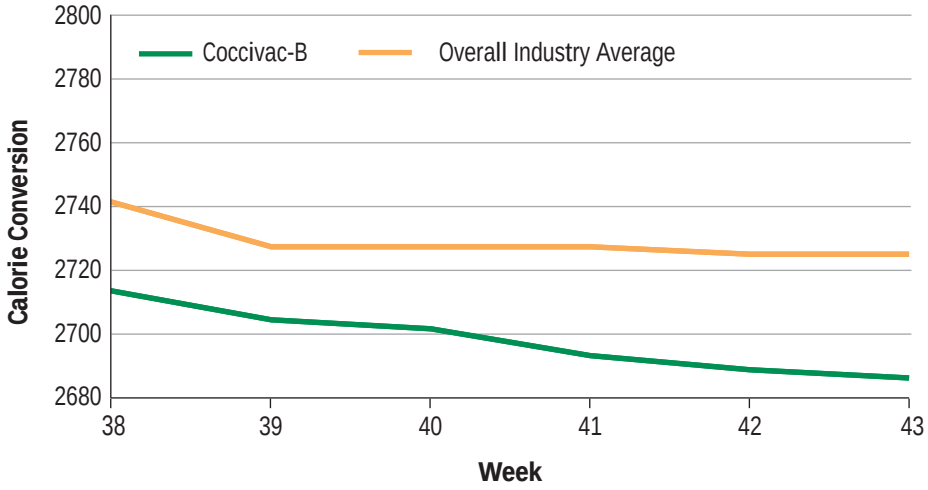
Think long-term

These new data, he stresses, give direct-line comparisons at the same time against variable programs. "It shows that Coccivac-B is equal to or superior to those traditional programs, even though the numbers might not be quite as good in the summertime as in the fall. That's only natural, due to the heat, the humidity and major temperature fluctuations."

Phillips stresses also that in terms of optimizing control of coccidiosis, integrators would do well to think long-term, rather than confining their focus to immediate needs or concerns.

"We feel strongly that integrators can often improve long-term performance by using Coccivac-B in an annual program," he adds. "That can be a big help in renewing the sensitivity of the house coccidial population to the most effective anticoccidials."

Figure 5. Fall Calorie Conversion (Adjusted to 5 lbs) Coccivac-B vs. Overall U.S. Industry Average



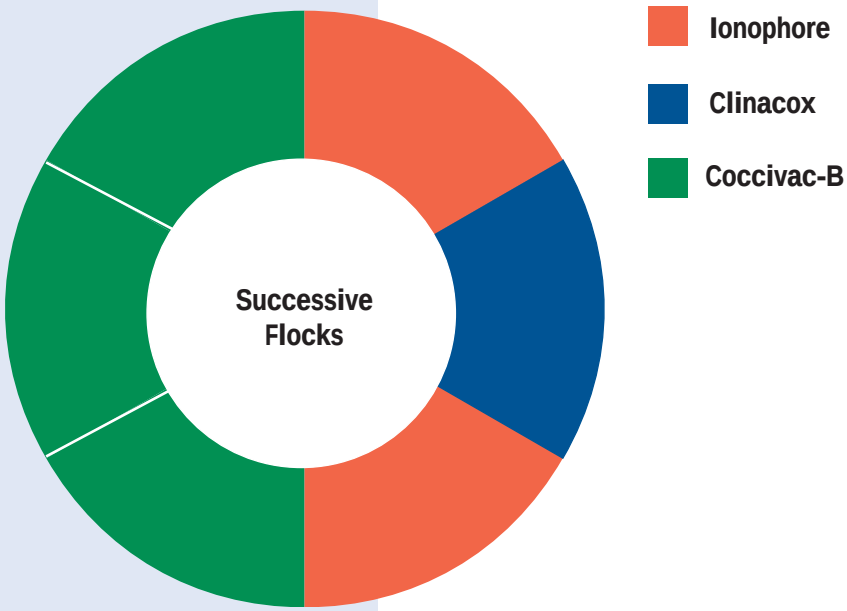
Today's Rotation Strategies

The poultry industry is no stranger to rotating products for maximum performance. But with coccidiosis vaccination being used by most mainstream producers for at least a part of their program, the game plan has changed considerably.

The process generally starts with discontinuing a worn-out ionophore and using Clinacox (diclazuril) in the starter feed only, for one cycle. Clinacox zaps the wild strains of coccidia that have been brewing over the years and effectively cleans up the house.

In the following cycle, producers switch back to an ionophore for one cycle before rotating to Coccivac-B, a vaccine that uses a controlled, balanced dose of coccidia oocysts to stimulate natural immunity for the life of the bird. The vaccine is used for at least three cycles. Coccivac-B also seeds the house with an older generation of oocysts that are highly susceptible to salinomycin and other older anticoccidials.

Figure 6. Long-Term Strategy for Coccidiosis Control, Six Cycles.



After three or four cycles with the vaccine — a period when producers often see performance improvements in successive flocks — integrators have the option of either staying on the vaccine or switching back to an ionophore and starting the three-product rotation again. (See Figure 6).

"In a sense, using a live-oocyst vaccine is like putting an operation's coccidia populations in a time machine and sending them back in history more than 50 years," explains Dr. Rick Phillips, DVM, of Schering-Plough Animal Health Corporation. "After three or four cycles with the vaccine, the older ionophores act young again and do a much better job keeping coccidia in check — as long as they're not overused."

GUT DECISIONS

Managing nutrition to optimize intestinal health programs

As consumers grow more concerned about drugs in poultry feed and regulators tighten the screws on the range of therapeutics available, major poultry companies worldwide are placing more emphasis on vaccination for managing coccidiosis.

This is particularly evident in Europe, where an estimated 9% of broilers are now vaccinated for this costly and ubiquitous protozoan disease, a 700% increase over the past 3 years.

The switch from feed additives to vaccination has gone relatively smoothly, particularly with the development of a special spray cabinet that ensures uniform distribution of the vaccine to day-old chicks in the hatchery.

According to Dr. Fabio Paganini of Schering-Plough Animal Health Corporation, the increasing popularity of vaccination goes hand-in-hand with another emerging paradigm — that nutrition can and will play an even bigger role in managing health challenges.

"As the use of in-feed antibiotics or anticoccidials declines, producers will no longer be able to depend on these drugs to suppress the effects of poorly managed environmental conditions in poultry houses," Paganini says. "Nutrition therefore needs to be designed to guarantee the development of the immune system while minimizing the availability of nutrients for harmful bacteria's growth."

To address this emerging topic, Schering-Plough Animal Health Corporation recently brought 41 international poultry producers to New York City for a technical seminar focusing on the role of nutrition management in meeting the contemporary health challenges of the global poultry industry.

Conducted in the midst of a blustery coastal snowstorm that surprised New Yorkers with more than a foot of snow, the symposium featured technical presentations by international experts and a panel discussion in which speakers shared front-line experiences from around the world.

The gathering was an excellent opportunity for poultry producers to compare notes on the best strategies for managing nutritional programs of birds vaccinated for coccidiosis. More importantly, it offered new insights into future directions.

"There were some very enlightening presentations and discussions during the 2-day meeting," Paganini says. "This is relevant to poultry producers worldwide."

***CocciForum** is pleased to present this special report with highlights from the seminar. To request the full set of seminar papers, contact fabio.paganini@spcorp.com.*

TOPIC:

Broiler nutrient and energy need as influenced by genetics, nutritional and pharmaceutical environments

Achieving optimal performance in commercial broilers requires specialists in animal health, nutrition and husbandry to work effectively together, especially given the move away from in-feed anticoccidial drugs.

Genetic progress in the past 50 years has been impressive. A typical 1950s broiler reached 1.5 kg (3.30 lbs) with a feed conversion ratio (FCR) of 3.2 and took 11 weeks to get there. Its descendant in the 2000s can make it to 2.3 kg (5.07 lbs) in just 5.5 weeks and an FCR of 1.66.

Despite these gains, and despite the success of medication to keep it under control, coccidiosis remains the poultry industry's most expensive parasite, levying the world's producers about US$2 billion annually.

Impact of vaccination

Vaccination of birds against coccidiosis, while effective, is not without cost in terms of immune challenge and subse-

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Stillwater

quent energetic cost — manifested in greater feed consumption. The impact of immune stimulation on growth can be exacerbated by management issues such as drafts, temperature fluctuations, crowding and air quality.

Mistakes in these areas can open the way for infectious agents to overwhelm the immune system. This could lead to altered management recommendations to protect vaccinated birds during brief yet critical times in the production cycle.

Impacts of drugs

Anticoccidials and ionophores can also have negative effects. For example, nicarbazin has been shown to increase mortality during high humidity-high temperature stress periods. Ionophores can also have undesirable consequences. Drugs such as monensin, salinomycin and lasalocid affect translocation of ions (hence the name) across membranes. They can affect birds' mineral balance and thus water consumption, which can lead to problems with wet litter.

The impact of ionophores needs to be managed within the overall electrolyte nutrition of broilers. When moving from an ionophore-based cocci-control program to vaccination, the feed formulation needs to be altered for the absence of ionophores as well as the enhanced immune system activity.

Nutrition

Nutrition management requires a juggling of priorities for optimizing profit while catering for the energy costs associated with variables such as stocking density, hygiene, lighting and watering systems.

Setting goals

Any formulization program should be driven by principle goals. These are some principle goals — and some considerations if they are to be the focus:

- **Live body weight and FCR.** Without correct adjustments to protein levels, birds will develop an over-fat carcass.
- **Lean mass production plus breast and/or specific parts yield.** By slowing growth of offal protein and carcass and offal lipids, live bird mass and FCR will not be optimized. Tight management of non-nutritive factors is important to control energy demands.
- **Coping with environmental challenges that elevate mortality.** The approach is to keep up carcass growth while downsizing metabolic demand. It may take longer for birds to reach market weight.
- **Least cost for live weight — lowering the ration cost.** While FCR will fall, the approach is to provide enough nutrition for growth to occur, given enough time. Nutrition standards shouldn't be lowered to the point that birds are over-fat.

TOPIC:

The importance of nutrition in the initial phase — developing the intestinal tract and immune capacity

PRESENTER:

Antonio Mario Penz, Jr., PhD
Universidade Federal do Rio Grande do Sul
Brazil

There is still considerable room for improvement in feed conversion ratios, which means that every year, broilers must eat less to achieve the same weights.

In terms of nutrition, this puts broilers on something of a knife's edge when it comes to achieving their potential. This is especially so in the first few days of life. Because broilers are being selected for lower feed consumption, their immune systems and very survival face greater challenges than before.

The digestive tract undergoes major anatomical changes during the first few days of life. The passage of feed during this phase has a big impact on this development and the way nutrients are absorbed later in life.

The immune system starts to develop during the embryonic phase and continues for the first week after hatching. A delay in water and feed consumption suppresses the immune system.

While the yolk sac sustains the newly hatched chick in the first few hours, it needs the stimulation of solid feed to get the digestive system developing properly. Delaying water and feed during this crucial period reduces the use of available nutrients in the yolk sac.

Under practical conditions, chicks arrive at the farm 24-36 hours after hatching. Delays in feeding during transport, sexing and vaccination can affect later development. Conversely, the benefits of early feeding give an advantage that is maintained through to market age (Table 1). It is important, therefore, to put chicks in contact with feed as soon as possible in the first day of life.

Other tips and observations

- The use of *lipids* in pre-starter diets should be restricted, as animal fat digestibility is very low at this stage. Furthermore, undigested fat could become an energy source for bacteria in the intestine.
- *Sodium* intake is another important consideration for the first week. Increasing levels of sodium are associated with increased weights due to higher water retention.
- Average *particle size* in pre-starter diets can affect performance, having an impact on metabolizable energy, nitrogen retention and dry matter retention.
- Addition of *protein* and fat to pre-starter diets can affect abdominal fat percentages by slaughter.
- Restricting *water* consumption directly affects feed consumption and thus the broiler's performance.

Table 1
Performance of broilers given feed and water immediately after hatching compared with those with a 24-hour delay.

	Weight Gain, g (lbs)		% Mortality	
Placement	**1-21 days**	**1-49 Days**	**1-21 Days**	**1-49 days**
	P < .001	P < .01	NS	P < .05
Immediate	647 (1.43)	2654 (5.85)	2.0	6.3
24-hour delay	598 (1.32)	2569 (5.66)	1.5	10.5

PRESENTER:

Joaquim Brufau, PhD
IRTA Research Center
Spain

TOPIC:

Increasing digestibility using vegetable- and drug-free feed

A series of high-profile food scares in Europe — mad cow disease, antibiotic resistance and dioxin contamination, to name a few — has led to tighter regulations to help restore consumer confidence in the food sector.

Antibiotics in animal feed and antimicrobial growth promoters are being phased out to help reduce the risk of resistance to antibiotics used in human medicine.

Banning antimicrobial growth promoters (AGP) will improve consumer perceptions but has the potential to create animal health problems, including:

- Reduced efficiency of feed utilization, especially where management or hygiene standards are poor.

- Increased disease related to *Clostridium perfringens*, e.g., necrotic enteritis (NE), chronic hepatitis.
- More wet litter problems because of increased NE.

Given the high use of wheat and barley in European poultry diets, feeding programs and feed composition may be important factors in disease when AGP are withdrawn. The soluble non-starch-polysaccharides (NSP) in these cereals can cause a range of digestive problems, especially in rye-based diets where elevated numbers of *C. perfringens* are reported. NSP-degrading enzymes are used to mitigate this problem.

Diet is also an important factor in coccidiosis, and Spain's department of animal nutrition has been studying the relationship between feed components and coccidiosis vaccination with Schering-Plough Animal Health.

The study compared performance of vaccinated birds on US-type corn-based diets with European wheat- or rye-based diets (with or without the NSP-degrading enzymes). Different nutritional strategies to improve performance of birds vaccinated against coccidiosis were also studied.

Performance issues relating to the age in vaccinated birds and their feed programs have been identified, but it appears that improving the digestibility of European broiler diets (e.g., through enzymes) could enhance the performance of vaccinated birds. Better digestibility will also help reduce the impact of *C. perfringens* and others.

TOPIC:

Control of necrotic enteritis in drug-free birds

PRESENTER:

Magne Kaldhusdal, PhD
National Veterinary Institute
Norway

Research and development for the production system is based on in-feed antibiotics used for managing necrotic enteritis (NE). Their eventual abolition will require a more multidisciplinary approach, especially for dealing with NE associated with *Clostridium perfringen*s.

Many factors directly and indirectly affect the severity of *C. perfringens*-associated problems. Understanding and learning how to manage them is the key. It is clear that much more research is needed to understand the mechanisms and efficacy of alternative methods for NE control.

Coccidiosis control. Coccidiosis predisposes birds to NE. Commercially, vaccinated birds are protected from coccidiosis and perform on par with medicated birds. However, additional measures to protect against NE are needed in vaccinated (non-medicated) birds.

Digestibility for young birds. Digestibility is not very relevant for young birds protected by in-feed medication, but it becomes significant when the antibiotics are removed. High digestibility is important to prevent the accumulation of a substrate that favors development of *C. perfringens.*

Dietary fat. Young birds digest some fats better than others and this can affect levels of *C. perfringens.*

Cereal type. Wheat- and barley-based diets appear to encourage greater proliferation of *C. perfringens* than corn-based feed. The action of dietary enzymes on the cereals may be implicated. Plant breeding might be used to optimize performance of different cereals in this respect. However, more research is needed into the mechanisms of this relationship between cereal type and NE risk.

Cereal storage. The length of storage (longer is better for wheat and barley) and the method of storage (air-tight for barley and oats), seem to have a positive effect on digestibility.

Dietary protein source. Diets high in protein, especially non-digestible protein, favor growth of *C. perfringens.*

Feed processing. Many factors in feed processing affect vulnerability to NE. These include use of pelleting, which appears to have both positive and negative effects. Heat affects digestibility and could open the door for *C. perfringens* by killing less-resilient competitors. Particle size can be a factor in digestibility for some ingredients.

Whole grain feeding. Whole grain wheat can reduce *C. perfringens* counts, but it is not known why.

Microbial cultures. These may help resist the onset of NE by quickly establishing healthy cultures of gut flora in young birds. Microbial cultures can also encompass probiotics which include microorganisms and some of their products.

Prebiotics. These are food ingredients that encourage the development of beneficial bacteria in the hindgut.

Supplementary enzymes. These are used to optimize digestive function. It is not clear whether these are directly useful for preventing NE.

Plant products. Some plant products such as essential oils appear to reduce counts of *C. perfringens*, but more work is needed to support their use against NE.

Immunity. Maternal antibodies against *C. perfringens* seem to protect birds from NE for the first 2-3 weeks. On the strength of this, there could be potential for a vaccine to stimulate maternal or active immunity and contribute to NE control.

Management. The "farm effect" of stocking density, lighting programs, feeding methods and the state of litter all contribute to the NE status of a poultry operation.

Infection sources. *C. perfringens* spores are very difficult to kill, and survive disinfectant treatments between grow-outs. It can be carried in feed, but there are numerous environmental sources.

PRESENTER:

Phillip Hargis, PhD
Hargis Associates
USA

TOPIC:

Economic advantage of managing nutrition in coccidiosis-vaccinated broilers

In terms of economy, coccidiosis vaccination is competitive with using in-feed anticoccidials, but a few changes must be made to feed formulation, feeding program and broiler-house management to ensure success.

Do not expect performance of vaccinated broilers to exceed performance in programs using ionophores and/or chemical drugs. The cost of production will be the same for either option.

The most economically feasible strategy is to use conventional drug programs with lighter birds (1.7 kg – 1.9 kg/3.75 – 4.19 lbs) and coccidiosis vaccination programs along with conventional programs for birds taken through the heavier weights.

There is only so much a feed program can do to enhance the effectiveness of vaccination. In addition to nutrition, there are several other key factors in the success of a coccidiosis vaccination program:

- **Time of year.** It's best to introduce vaccination between April 1 and November 1, when houses are dry and challenge low. Year-round use can be phased in later.
- **House management.** Litter condition is crucial; so is the ability to control environmental conditions.
- **Lighting.** No dark periods to limit feed intake and no continuous bright lights to overstimulate activity and utilization of nutrients, thus over-taxing the coccidiosis-challenged gut.
- **Genetics.** Birds that feed well in early life do better under vaccination programs.

Where regular drug programs also involve vaccination, there are critical "companion drugs." Likewise, there are important companion ingredients such as sodium bicarb, phytase and betaine.

Feed formulations to support vaccination programs

Vaccinated birds need time to overcome the early coccidiosis challenge. Once the second challenge is passed, the formulation should maximize growth from day 30 on. Before this, there are two critical periods: 17-21 days and 27-30 days. Feed for-

mulation must be closely controlled with no changes at these times.

Some other important tips for nutrition programs are:

- Use high-digestibility ingredients
- Use ingredients low in peroxides and gut-corrosive properties
- Minimize mycotoxin exposure
- Minimize bird stress via ingredient quality
- Minimize ingredients that promote intestinal fermentation
- Avoid feed reformulations or switching to cheaper ingredients.

Integration with ionophore drugs

Coccidial vaccines "revive" over-used and abused ionophores. Take advantage of this by following a vaccination cycle with the weakest in the current drug program.

TOPIC:

Nutritional programs to optimize performance in drug-free diets — the Brazilian experience

PRESENTER:

Ronei Gauer, PhD
Nutrition Consultant
Brazil

Each 1 kg (2.2 lbs) on a Boeing 767 consumes an extra 200 liters (52.8 gallons) of aviation fuel per year. In the broiler industry, the extra "weight" in a diet can also drag down productivity.

In Brazil, two factors are leading to the demise of coccidiostats and growth promoters in poultry feed: consumer resistance, and declining efficacy. Doses of anticoccidials have been increased to combat resistance to antibiotics.

The investment in drugs has diverted poultry industry investment from more productive lines of research, such as feed and water quality, and training of personnel.

In Brazil, a number of strategies have now been identified to help maximize performance in drug-free production systems that employ vaccination against coccidiosis:

- **Quality of ingredients.** Higher quality raw material improves digestibility and leaves less substrate for bacterial development.
- **Particle size.** Whole cereals can stimulate the gizzard and may help with digestion and suppression of salmonella.

• **Feed processing.** Temperatures and pressure can affect feed absorption.
• **Organic acids.** These can impede the invasion of birds by bacteria.
• **Protein/enzymes.** Minimizing non-absorption of protein denies bacteria such as *Clostridium perfringens* a substrate for development. Enzymes help maximize protein absorption.
• **Betaine.** This helps decrease incidence and severity of intestinal lesions in vaccinated birds and could help improve feed conversion rates.
• **Differentiated diets.** Weight gain, pigmentation and feed conversion can be issues in vaccinated birds if diets are not adjusted appropriately at crucial periods — for example, reducing protein levels in starter feed (10-20 days).
• **Pre-starter feed.** This should be used until immunity builds up. High-quality ingredients are essential.
• **Starter feed.** Lower levels of crude protein are required as the immunity-building process peaks. This helps control bacterial growth.
• **Variability.** With more digestible feed and more consistent quality and other refinements such as enzymes, it will be possible to minimize bacterial challenge that was previously controlled with antimicrobial growth promoters. Work is also needed to improve management of the basics (e.g., water quality) among the poorest producers.

Taken together, the strategies are tipped to offer a cumulative FCR improvement of 0.18 g per kg of gain (0.0008 per lb).

PRESENTER:

Amatzia Eyal, PhD
Nutrition Consultant
Israel

TOPIC:

Nutritional programs to optimize performance in anticoccidial-free diets — the Israeli experience

Comparative trials in Israel have shown very similar performance results for coccidiostat-treated birds and birds vaccinated against coccidiosis.

The birds were split into male and female groups, with different feed regimes for the vaccinated and medicated birds. The vaccinated birds received diets designed to reduce mortality and feed cost without compromising performance. The feed for both groups was based on corn and wheat because of the Israeli market requirement for white skin.

In both the male and female groups, finished weights were very similar for vaccinated and medicated birds.

An interesting result for both the male (+42 g/+0.092 lb) and female (+30 g/+0.066 lb) birds was that vaccinated animals yielded more breast meat than the medicated birds, but the reason has not been determined.

TOPIC:

Alternative feed programs in broilers vaccinated for coccidiosis — the Spanish experience

Traditional feed programs in Spain are designed around the withdrawal period from a coccidiostat. Using a vaccine that provides lifelong immunity instead of an in-feed anticoccidial has allowed producers to focus on managing feed ingredients for optimum performance — without worrying about drug treatment or withdrawal times.

The added flexibility allows operations to:

- Provide the right start for broilers with the highest possible feed digestibility during the crucial 14-28 day period.
- Use lower-cost finishing rations for longer periods, without compromising production.

Trials were conducted at Nutreco Group's experiment station in Spain to compare the impacts of conventional and modified diets in drug-treated (nicarbarbazin/monensin) and vaccinated birds.

Trial 1: Use of high-digestibility rations at an early age

The trial compared performance using the conventional starter (0-20 days), grower (21-42 days) and finisher (43-49 days) program with an alternative that split the 0-20 day program into two phases — a pre-starter and starter feed. The aim was to optimize the pre-starter period performance and to promote digestibility during the starter period with a less concentrated feed.

For the total study (0-49 days), the final weight of vaccinated broilers on the alternative feed program was clearly better than weights for medicated birds on a conventional diet. There were no significant differences in mortality or real feed conversion indexes.

Trial 2: Use of different finisher diet periods

The trial split vaccinated birds into conventional and alternative starter programs as in the first trial, but also looked at the impact of varying the finisher feed periods. A medicated group was also tested.

The study concluded that it is practicable to prolong the use of finisher diets without impairing final performance — something that might reduce the cost of feeding programs for vaccinated broilers.

Trial 3: Combined studies 1 and 2

A trial at the IRTA experimental station revisited the impact of digestibility at earlier stages as well as using feeding finishing diets for longer periods with some refinements.

Once again, the trial confirmed that with correct husbandry and ambient conditions, performance of vaccinated broilers matches that of medicated birds. Interestingly, both vaccinated and medicated birds benefited from the alternative feed programs. It also demonstrated the benefits of using alternative diets in vaccinated birds.

In vaccinated chickens, longer finisher/withdrawal diet periods at a lower cost did not compromise weights, mortality or feed conversion ratio (FCR), nor did it increase risk of late coccidiosis outbreaks.

The results were consistent with practical experience in Spain.

PRESENTER:

José Ignacio Barragan, DVM
Nutrition Consultant
Spain

For more insights from Dr. Barragan, see his Technically Speaking article beginning on page 20.

PRESENTER:

Peter Woodward, BSc
Poultry Nutrition Specialists
Hereford, UK

TOPIC:

Managing nutrition for coccidiosis-vaccinated birds — UK trial results and novel marketing concepts

Over the past several years, there has been a series of small-scale and commercial-scale trials to explore ways to maintain gut health in chickens vaccinated against coccidiosis in the UK and Ireland.

Small pen trials in the UK in 2000-01 aimed to develop a nutritional program for vaccinated birds that provided performance at least equal to conventionally raised chickens and at a comparable cost.

Despite increased mortality, the best economic performance was observed with vaccinated birds on high-density starter diets with high-quality proteins. Protein source (fishmeal or soya meal) was not a factor. Savings in feed cost offset the cost of vaccination.

Further trials in Ireland last year looked at the effects of raw materials and dietary additives in the diets of vaccinated birds.

In the first trial, some of the bioflavonoid additives showed potential synergistic responses. In trial 2, vaccinated birds were given either vegetable or fishmeal protein sources. As long as nutrients were balanced following removal of fishmeal from the diet, there were no nutritional factors interfering with the birds' response to vaccination.

Trials have also been held in a UK commercial environment over the past 2 years. The farm chosen had experienced a range of health problems including clinical coccidiosis. Performance of vaccinated birds was inconsistent, although improvements were noted with subsequent crops.

It was concluded that more needs to be known about the dynamics and factors critical for vaccination. It was also noted that successful and economic performance using vaccination against coccidiosis will be achieved through combinations of feed manipulations and modifying management standards.

TOPIC:

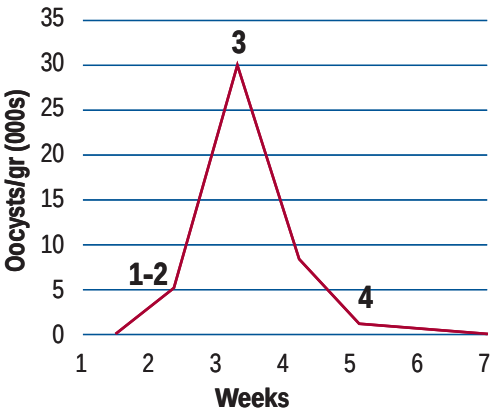
A nutritional concept for vaccinated birds — IDEA program

PRESENTER:

César Carnicer, PhD
Poultry Business Manager
Schering-Plough Animal Health
Spain

The research results from Spain presented by Dr. Barragan (page 15) indicated that nutrition programs for vaccinated birds are free from the constraints imposed by withdrawal times. As such, they can be adapted to better suit their nutritional needs and the producers' economic needs.

Dr. Carnicer developed this theme by proposing a good "IDEA" in the form of a nutrition program that fits the dynamics of *Eimeria spp.* during the production cycle of vaccinated birds.



The accompanying graph shows the classical oocyst-excretion curve of well-managed, vaccinated birds. There are three oocyst cycles, with peak production occurring typically during the third, at 21-28 days.

Good uniform vaccine coverage is essential to ensure that all birds begin the cycling process together, which in turn leads to uniformity in oocyst cycling and immune development.

Equally important to the success of a coccidiosis vaccination program is the overall quality of poultry house management. This includes everything from cleanout before the introduction of a vaccinated flock, to bedding, temperature control, litter moisture, flock density and warmth.

By adapting nutrition programs to the physiological situation in the intestine of vaccinated birds and matching nutrient needs to the building of immunity in each period, vaccinated birds will perform better. This is spelled out in the **IDEA** concept:

I: Impulse phase (1-2 in graph). Prepare the immune system and intestinal cells to develop immunity against coccidiosis; at the same time an adequate start for the fattening period is provided.

D: Digestibility or **Developing** phase (2-3) in graph). Help the immune system and intestinal cells build immunity. This is important not only for coccidiosis, but also because most intestinal infectious problems and disturbances occur in this period.

E: Economic advantage (4 in graph). Take advantage of birds' immunity against coccidiosis with good intestinal health.

A: An **Advance** in poultry farming and a good **Alternative** for the new era when in-feed additives will no longer be available.

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

Charles Broussard, DVM

Q. LAST YEAR, LITTER SAMPLES SENT FROM MY COMPLEX FOR ANTI-COCCIDIAL-SENSITIVITY TESTING SHOWED POOR SENSITIVITY FOR CLINACOX (DICLAZURIL), SO WE USED COCCIVAC-B FOR THREE GROWOUT CYCLES. WHEN WILL WE BE ABLE TO USE DICLAZURIL AGAIN?

A. Recent studies have demonstrated that sensitivity to Clinacox is restored following two to three complete cycles of Coccivac-B. In order to maximize the restoration effect, we recommend using Coccivac-B for at least three cycles between Clinacox usage.

(For more on the latest rotation strategies, see article on page 2.)

Steve Fitz-Coy, PhD

Q. IS IT ALWAYS NECESSARY TO TEST FOR ANTICOCCIDIAL SENSITIVITY BEFORE USING CLINACOX?

A. No. Testing isn't needed if Coccivac-B has been used in the rotation program for at least two complete cycles. Consider anticoccidial testing when Coccivac-B has not been used or when Clinacox has been used extensively in both starter and grower feeds, when Clinacox was used for two growout cycles, or when there has not been an adequate amount of rest time between usage.

John McCarty, DVM

Q. IN TERMS OF PERFORMANCE, HOW DO BIRDS ON COCCIVAC-B COMPARE TO THOSE ON STANDARD IONOPHORE ANTICOCCIDIAL PROGRAMS?

A. In 2003, we had an excellent opportunity to compare weekly performance parameters in 23 complexes vaccinated with Coccivac-B to complexes on standard ionophore anticoccidial programs for the same time period.

Weekly averages for performance parameters, such as days to 5-lbs and calorie conversion to 5-lbs for Coccivac-B flocks, were equal to or better than the flocks on standard anticoccidial programs in both hot and cool weather months.

(For more information, see article beginning on page 2.)

Q. WHAT IS THE BEST WAY TO USE CLINACOX TO MINIMIZE RESISTANCE DEVELOPMENT AND TO MAXIMIZE PERFORMANCE?

A. Clinacox is an effective synthetic anticoccidial introduced to the US broiler market in 2000. As with any other chemical, however, Clinacox must be used judiciously to minimize the development of resistance.

In a recent study with a major US poultry company, we compared the sensitivity of field *Eimeria spp.* populations to Clinacox before and after Coccivac-B use. We found that the use

continued on page 19

Linnea Newman, DVM

of Coccivac-B in a rotation program has the unique ability to restore the efficacy of Clinacox. Based on these results, we highly recommend using three cycles of Coccivac-B in rotation with only one Clinacox cycle, and the Clinacox should be used in a shuttle program with another anticoccidial product.

Q. DOES HATCHERY LIGHTING HAVE ANY EFFECT ON COCCIDIOSIS VACCINATION?

Rick Phillips, DVM

A. Yes. Lighting in hatchery holding rooms is very important for day-old chicks that are vaccinated for coccidiosis. Chicks will begin to clean, dry and oil their feathers after vaccination, an instinctive behavior called preening. Preening should be encouraged, since this is the way that oocysts are ingested. Good lighting and comfortable temperatures encourage preening and are required for proper vaccination.

Q. WE'RE GOING TO START USING COCCIVAC-B THIS SPRING. HOW DO WE ENSURE MINIMAL, CONTROLLED REACTION TO MAXIMIZE OUR PERFORMANCE WITH THE VACCINE?

John Radu, DVM

A. There are three key elements to managing Coccivac-B through the immunity-building period, and they are the same as house management aimed at maximizing broiler performance in general. They are:

- Brooding to minimize stress
- Unrestricted feed access
- Litter moisture management

Coccivac-B vaccinates should not be stressed by cool or damp litter.

Litter depth should provide good insulation from the floor. Brooders should be set to provide a comfort zone incorporating both feed and water for the chicks at a temperature that encourages good feeding activity.

Good ventilation, combined with moving birds to full house between 7 and 14 days of age, will control litter moisture. All flocks, regardless of stocking density, should be in full house by no later than day 14.

Care must be taken to avoid accidental or intentional feed restriction during the first 3 weeks, when active coccidial cycling takes place. As always, it isn't just the management program, it's the execution of the program that counts.

Q. WHAT FACTORS MIGHT LEAD TO COCCIDIOSIS VACCINE FAILURE?

A. Improper administration of the vaccine can result in vaccine failure. Be sure to use the vaccine as recommended by the manufacturer (correct volume per unit birds), allowing proper wetting. Encourage preening, since it is through preening that birds ingest the vaccine. Studies have shown that early ingestion of *Eimeria* oocysts was associated with more substantial immunity.

Overcrowding birds in brood areas and greater density allow unwanted and severe subsequent exposures. Drastic management changes might also interfere with successful vaccination since birds are creatures of habit and sudden change can be stressful. Interruptions in the life cycle of coccidia, as might occur with the use of anticoccidials, can also interfere with successful vaccination. Proper nutrition is also important for consistent intestinal health.

COCCIDIOSIS VACCINATION ENABLES MORE FLEXIBLE DIET

Review your program to minimize coccidiosis pressure and maximize control

Dr. José Ignacio Barragan
Poultry Veterinarian and Independent Nutritional Consultant
Spain

As long as commercial poultry operations have been in existence, nutritionists have tried to appraise the impact of feed nutrients and the changing dietary needs of broilers. They have also sought to find and control anti-nutrition factors present in the feed.

In many cases, nutritional needs are linear but diminish as chickens grow older. In other words, as birds age, the dietary contribution of the feed differs and, in general, diminishes.

An important factor to consider is the chicken's sensitivity to the diet's energy level. There is practically a linear relationship between energy levels in the diet and the feed conversion index. Since the feed conversion index is the most important factor affecting the cost of broiler production, it is generally the first element defined by nutritionists. Once this value is established, remaining nutrients are defined in terms of the estimated consumption according to the energy level and the needs of the production phase.

Another important dietary decision is the length of time that each feed type should be used. First consider the number of feed types that the mill can manufacture based on its capacity and the logistics involved. In general, feed mills usually handle three different broiler feed types and, under certain circumstances, four, but it is usually difficult to increase this amount. Generally, the more types of feed that can be manufactured, the better the nutritional needs of chickens can be met. On the other hand, the mill's capabilities are usually considered before cost optimization.

Once the amount of different broiler feed types is established, the age limits for the use of each feed must be determined. In theory, this should be the most economical feeding program. In reality, though, the feeding program is significantly influenced by the anticoccidial program.

Traditional programs

For years in Spain and many other countries with a long tradition of poultry farming, the coccidiosis control program consisted of a chemical product, which generally was nicarbazin during the first weeks followed by an ionophore (e.g., monensin, salinomycin). The optimum period of time that nicarbazin can be used is 21 days, since less time reduces its efficacy, while more increases the risk of growth depression; in addition, different regulations require that this anticoccidial be withdrawn a certain number of days before slaughter.

As a result, the more universally used formulation programs have had a starter feed until 21 days of age, a grower feed until a few days before slaughter (depending on the regulations) and a withdrawal feed until slaughter. This is the way it has been done, even though it may not be the most technically or economically ideal program.

The situation differs when chickens are vaccinated to control coccidiosis. The length of time that finisher feed is used is not determined by concerns

Dr. Barragan, a graduate of Madrid University, has worked as a production manager, a nutritionist and technical advisor for leading poultry and animal health companies. Currently he is an associate professor at the Veterinary School of Valencia, an independent nutritional consultant for several leading poultry companies and president of the Spanish association of WPSA/AECA.

that chickens will suffer from coccidiosis in the late — and expensive — grow-out period. These new circumstances also allow feed to be formulated for times that the chicken's intestines are battling *Eimeria* introduced by the vaccine, which is the period between 15 and 25 days of age.

Vaccinated birds

Feeding programs for chickens vaccinated against coccidiosis should have three different objectives. They should:

- **Develop the immunological system**. The feed should promote growth and good immunity system function.
- **Provide birds with the best defense for replication periods** by providing good digestibility and, when possible, preventing other complicating factors such as necrotic enteritis.
- **Utilize the resistance to coccidiosis created in birds** to maximize growth for the lowest cost possible in the final grow-out period.

This triple objective can be achieved more easily with a feeding system that's different from the one used now. It would provide the use of:

- An "impulse" (pre-starter) feed from 0 to 14 days of age
- A highly digestible feed from 15 to 30 days
- A technically and economically useful feed from 31 days until slaughter.

Field trials

To test this new diet, trials were conducted at one of the most prestigious experimental farms in Spain. In one trial, 4,500 Hybro males were used. The birds were divided into three groups: those that received an anticoccidial, those that did not, and those that were vaccinated against coccidiosis. Among each of the three groups, half received the conventional diet and half received an alternative diet (Table 1).

The conventional feeding program consisted of the following feed types:

- P1: Starter. From 0 to 21 days, with 3020 Kcal; 23.6% total protein and 1.1% of available lysine.
- P2: Grower. From 21 to 42 days, with 3250 Kcal; 23% protein and 1.05% of available lysine.
- P3: Finisher. From 43 to 49 days, with 3250 Kcal; 21.9% protein and 0.95% of available lysine.
- P1 feed was given as crumbs and P2 and P3 as granules.

Table 1. Treatment groups and feeding programs used in the trial.

Code	Anticoccidial	Feed Program
C-1	(C-) None	(1) Conventional
C-2		(2) Alternative
C+1	(C+) Standard	(1) Conventional
C+2		(2) Alternative
V1	(V) Paracox-5	(1) Conventional
V2		(2) Alternative

The alternative feeding program consisted of the following feeds:

- P0: A pre-starter from 0 to10 days, with 3000 Kcal; 24% protein and 1.3% of available lysine.
- P1: A starter from 11 to 21 days, 2850 Kcal; 23% protein and 1.04% of available lysine.
- P2: A grower.
- P3: A finisher.

Feeds P2 and P3 are identical to the conventional feeding program. In the alternative program, all diets were given in granular form. The P0 and P1

granules were smaller to accommodate smaller birds.

The goal of the alternative diets was to ensure the best possible start for chickens and to facilitate digestibility during the first 21 days of age with a less concentrated feed. Results for the period from 0 to 10 days are presented in Tables 2, 3 and 4.

Table 2. Results from days 0 to 10.

Treatment Code	Initial Live Weight	Final Live Weight	Daily Weight Gain	Average Daily Feed Intake	Adjusted Feed Conversion Rate	Real Feed Conversion Rate	Mort %	Eliminated %
C+1	45.2	217^{c}	17.18^{c}	23.3^{cd}	1.358^{b}	1.386^{b}	4.66	0.66
C+2	45.2	237^{b}	19.22^{b}	24.0^{bc}	1.251^{c}	1.275^{c}	5.06	0.53
C-1	45.1	210^{cd}	16.51^{cd}	22.8^{d}	1.388^{ab}	1.417^{ab}	4.93	0.40
C-2	45.1	254^{a}	20.93^{a}	25.1^{a}	1.202^{d}	1.226^{c}	4.66	1.06
V1	45.1	204^{d}	15.95^{d}	22.4^{d}	1.408^{a}	1.446^{a}	5.60	0.53
V2	45.1	251^{a}	20.63^{a}	24.7^{ab}	1.200^{d}	1.233^{c}	6.80	1.20
Pr>F	0.99	0.0001	0.0001	0.0001	0.0001	0.0001	0.61	0.41
CV*	0.72	4.14	5.15	3.89	3.43	4.05	_	_
Median	45.1	229	18.40	23.7	1.301	1.330	5.28	0.73

** Coefficient of variation.*
Numbers with different letters are statistically different.

Table 3. Results from days 10 to 21.

Treatment Code	Initial Live Weight	Final Live Weight	Daily Weight Gain	Average Daily Feed Intake	Adjusted Feed Conversion Rate	Real Feed Conversion Rate	Mort %	Eliminated %
C+1	217.0^{c}	682^{d}	42.29^{d}	65.3^{d}	1.544^{ab}	1.548^{ab}	0.00	0.14
C+2	237.5^{b}	756^{b}	47.16^{b}	73.4^{b}	1.558^{a}	1.563^{a}	0.70	0.00
C-1	210.2^{cd}	705^{c}	45.02^{c}	66.8^{c}	1.485^{d}	1.492^{d}	0.56	0.28
C-2	254.5^{a}	826^{a}	51.98^{a}	79.0^{a}	1.521^{bc}	1.527^{bc}	0.41	0.27
V1	204.7^{d}	694^{cd}	44.50^{c}	65.9^{cd}	1.483^{d}	1.497^{cd}	0.84	0.57
V2	251.5^{a}	821^{a}	51.82^{a}	78.0^{a}	1.505^{cd}	1.507^{cd}	0.14	0.15
Pr>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.18	0.46
CV*	4.14	2.46	2.61	2.29	2.06	2.28	_	_
Median	229.2	747.75	47.13	71.4	1.516	1.522	0.44	0.24

** Coefficient of variation.*
Numbers with different letters are statistically different.

Table 4. Results from days 0 to 49.

Treatment Code	Initial Live Weight	Final Live Weight	Daily Weight Gain	Average Daily Feed Intake	Adjusted Feed Conversion Rate	Real Feed Conversion Rate	Mort %	Eliminated %
C+1	45.2	3049^{bc}	61.3^{b}	109.2^{d}	1.781^{c}	1.88	12.93	1.2^{ab}
C+2	45.2	3098^{ab}	62.30^{ab}	111.8^{bc}	1.794^{c}	1.93	16.4	0.8^{b}
C-1	45.1	3037^{c}	61.06^{c}	109.7^{cd}	1.796^{bc}	1.86	10.26	1.06^{ab}
C-2	45.1	3095^{abc}	62.25^{abc}	113.6^{ab}	1.826^{a}	1.93	12.26	2.4^{a}
V1	45.1	3049^{bc}	61.30^{bc}	111.3^{c}	1.816^{ab}	1.89	11.33	1.33^{ab}
V2	45.1	3132^{a}	63.01^{a}	114.8^{a}	1.822^{a}	1.94	14.40	2.00^{ab}
Pr>F	0.99	0.005	0.005	0.0001	0.0001	0.056	0.09	0.04
CV*	0.72	1.98	2.01	2.009	1.23	3.59	_	_
Median	45.1	3077	61.87	111.7	1.806	1.91	12.93	1.46

** Coefficient of variation.*
Numbers with different letters are statistically different.

The results show that body weights at 10 and 21 days and at the end of the trial are higher in birds fed with the program consisting of a pre-starter and a more digestible starter compared to those fed the standard program. These differences are significant in all three production periods as well as in the three coccidiosis control programs (anticoccidial, no anticoccidial and vaccinated). The largest appreciable difference in numbers regarding final bodyweight was seen in the vaccinated group.

The feed conversion ratio tends to be slightly worse, though not truly significant, in chickens fed the alternative program due to higher feed consumption. However, this slight increase in feed consumption does not limit the opportunity for final weight increase using the alternative program. The slightly increased cost of feed with the alternative program for the initial stages is due to the higher concentration of amino acids and improved characteristics of the feed ingredients.

To reduce the cost of feed and better utilize the immunity obtained against coccidiosis in vaccinated chickens, it is possible to modify the duration of the "third stage" feed (generally known as "withdraw" feed because it coincides with the withdrawal period of the growth promoters and coccidiostat). Studies by Saleh, Watkins and Waldrop have shown that, in high bodyweight chickens, a diet with the characteristics of a withdraw feed can be used for longer periods without affecting the technical results (Table 5).

We can see that increasing the use of withdraw feed in birds of medium bodyweight up to 14 days reduces the average weight in birds that received only grower, but not withdraw feed. However, when the test is repeated in heavy weight birds, there is no difference between chickens that consumed 7 or 14 days of withdraw feed.

With these results in mind, a trial was repeated at the same location of the first trial. The results for chickens with different withdrawal periods are compared in Table 6.

Table 5. Results in chickens fed a diet with the characteristics of a withdraw feed.

Experiment 1

	Live Weight	Conversion	Mortality (%)
21-42 days	2252[c]	1.783[a]	5.39
28-42 days	2282[bc]	1.753[b]	5.78
35-42 days	2323[ab]	1.745[b]	5.76
None	2365[a]	1.699[c]	3.76
Significance	***	***	N.S.

Experiment 2

	Live Weight	Conversion	Mortality
35-56 days	3299	2.016	7.50
42-56 days	3366	2.006	7.92
49-56 days	3337	1.993	8.05
None	3424	1.992	8.18
Significance	0.04	N.S.	N.S.

Numbers with different letters are statistically different.

A standard feeding program containing anticoccidials is compared with a series of alternative programs in vaccinated chickens consuming a first feed with two variations (normal and higher digestible, with lower levels of energy and protein/amino acids) and a second and third feed of variable duration, increasing the withdrawal period (Table 7).

The results show there is no difference between chicken weights regardless of the withdrawal period used or the feed conversion rate, even though it is numerically better in chickens that received the feed from 35 days of age.

This test was unable to establish differences between the chickens that received the two different first stage feeds, even though, numerically, the weights of chickens fed the more

Table 6. Results in heavy weight chickens that consumed withdraw feed for different periods of time.

		Feeding Program and Days of Usage						
Treatment	Coccidiostat	0-7	7-14	14-21	21-28	28-35	35-42	42-49
C+	N/M*	Starter Anticoccidial			Grower Anticoccidial			Withdraw
V-1	Paracox-5	Digestible Starter		Grower Without Anticoccidial				Withdraw
V-2	Paracox-5	Starter Normal		Grower Without Anticoccidial				Withdraw
V-3	Paracox-5	Digestible Starter		Grower Without Anticoccidial			Withdraw	
V-4	Paracox-5	Starter Normal		Grower Without Anticoccidial			Withdraw	
V-5	Paracox-5	Digestible Starter		Grower Without?		Withdraw		
V-6	Paracox-5	Starter Normal		Grower Without?		Withdraw		

*N/M = Nicarbazin/monensin

Table 7. Global results when standard program with anticoccidials is compared to alternative programs in vaccinated chickens.

	Initial		Withdraw (Day)					Pr>F	
	Normal	Digestible	28	35	42	Median	CV	Initial	Withdraw
Initial weight (g)	41.36	41.42	41.32	41.47	41.35	41.39	1.55	0.81	0.82
Finished weight (g)	2772	2749	2730	2749	2725	2736	2.91	0.34	0.78
Average daily feed intake (g/b/d)	103.04	103.65	103.74	103.11	103.33	103.35	1.85	0.36	0.76
Daily weight gain (g/b/d)	54.70	55.26	54.87	55.25	54.77	54.98	2.95	0.34	0.79
Adjusted feed conversion	1.753	1.757	1.765	1.745	1.759	1.755	2.50	0.77	0.51
Real feed conversion rate	1.812	1.796	1.802	1.789	1.821	1.804	3.12	0.60	0.43
Mortality (%)	6.94	6.39	5.28	5.71	8.65	6.66	—	0.73	0.64
Cond. (%)	1.66	0.55	0.55	1.07	1.54	1.11	—	0.17	0.91

n = 36

digestible, but less concentrated, feed were slightly lower. Neither was it possible to find differences between the processing results among chickens in the different treatment groups, nor in the values of litter quality or in *Eimeria* oocysts counts.

In the end, there were no significant differences between the results of the vaccinated and the anticoccidial-fed control groups.

From these trials, we can conclude that in chickens vaccinated against coccidiosis, it is possible to extend the time that finisher (withdrawal) diets are used if final weight will be higher than 2.4 kg (5.28 lbs), without having detrimental effects.

On the other hand, a starter diet with special characteristics may allow the birds to have a better "start" with improved resistance during the period of higher *Eimeria* replication.

Conclusion

Using an "impulse" starter feed, a highly digestible second stage diet fed between 15 and 25 days of age along with a finisher diet fed for a longer period of time than usual can better meet the needs of chickens vaccinated against coccidiosis.

Once liberated from the limits established by the use of a traditional anticoccidial program, poultry producers can have more freedom designing feed formulas and programs. Alternative programs might also benefit vaccinated chickens by providing them with better intestinal health, without increasing the cost of the feeding program.

HERE WE GO AGAIN

New disease-management trends are helping researcher Greg Mathis return to what lured him into the poultry industry in the first place — coccidiosis

Scan Greg Mathis' resume and you'd swear he was put on earth to control coccidiosis in poultry.

Born in Gainesville, Georgia, the broiler capital of the world, Mathis has pretty much devoted most of his post-graduate and working career to coccidiosis, conducting trials and reporting results in dozens of publications, proceedings and abstracts over the past 25 years. He's also an icon on the industry lecture circuit, presenting new information on coccidiosis management at poultry science meetings all around the world.

Between all his time at the computer and the podium, it's a wonder Mathis has any time for his full-time job — president and owner of Southern Poultry Research, Inc., Athens, Georgia, an independent testing facility that animal health and nutrition companies flock to for objective, real-world trials that can make or break a new product or idea.

'I really felt this was it — coccidiosis was what I wanted to do.'

But don't get the idea that Mathis' distinguished career is fulfilling some kind of prophecy or lifelong ambition.

"There was no vision, no shining light coming down from the sky," he insists, flashing his dry humor and self-effacing demeanor. Instead, The Greg Mathis Story is one of happenstance and fascination with the *Eimeria* organism that causes coccidiosis in poultry.

Sucked in

"I went to a small college and got a bachelor's degree in biology, but obviously, there wasn't much I could do with that," Mathis recalls. "I thought about becoming a vet, so I looked into the University of Georgia to see what they had available."

As it turned out, the university's poultry department had a few openings in its graduate program. "Also, a lot of the pre-vet advisors were into poultry, so I thought I'd go there and take some courses and then go on to vet school," he says.

But Mathis was quickly sucked into the current of the poultry college, where coccidiosis legends Malcolm Reid, Joyce Johnson (as in the Reid-Johnson scale of scoring coccidial lesions) and eventually the UK's Peter Long were teaming with rising stars like poultry science professor Larry McDougald to fine-tune diagnostic and control programs for this ubiquitous and costly disease.

"I really felt this was it — coccidiosis was what I wanted to do," Mathis remembers. "All I knew is that I didn't want to leave and go to vet school. I really wanted to finish what I was doing. I also felt like we were doing

something that was making a real and immediate difference for producers."

Mathis scrapped his plans for vet school, stayed at UGA and instead got his master's and PhD in poultry science, all the while working with some of the top coccidiosis scientists in the industry.

Unfortunately, full-time job opportunities were limited at the university when he completed his post-graduate studies, so Mathis and McDougald started a company called Georgia Poultry Research. Its simple mission was to help animal health companies evaluate and register growth promotants and anticoccidial feed additives.

"We had been doing anticoccidial testing at the university and decided we could do it off-campus a lot easier and get out of the university's way," Mathis says. "It wasn't that the university wasn't interested, but those types of trials take up a lot of floor-pen space — and that's space the university can use for basic research. It was a very active poultry department, and they really couldn't justify putting commercial studies into their houses. So Larry and I saw a need for an independent testing facility. We did anticoccidial FDA clearance work almost exclusively for about 4 or 5 years."

On his own

Mathis eventually bought out McDougald, who was still working at the university, and changed the company's name to Southern Poultry Research — a move that helped to separate it from the university and broaden its geographic reach.

Now in its twentieth year, the research company has its own feed mill with six storage bins, four floor-pen houses (each in separate locations for biosecurity), a climate-controlled battery cage facility with uniform temperature and illumination, a laboratory, a hatchery and a room full of fireproof file cabinets storing two decades of trials and FDA submissions.

The company, which Mathis owns and manages with Sally — his wife of 20 years who manages the Quality Assurance end of the company, including the large volume of paperwork that goes with every trial — still helps the animal health industry evaluate and register new products and claims. In the 1990s, however, Southern Poultry Research expanded its research services to include nutrition, infectious diseases and genetics.

'I also felt like we were doing something that was making a real and immediate difference for producers.'

"I didn't want to get away from coccidiosis, but things quieted down in the early 1990s as Europe started banning feed additives. The drug companies were understandably more reluctant to invest in new additives that might not have a chance of getting approved," Mathis says. "I really don't see that changing, either. In terms of new feed additives in the United States, it's been Clinacox (diclazuril) — and that's about it. I don't see anything else coming."

Nevertheless, Mathis is pleased that coccidiosis is once again the focus of many animal health companies' research programs.

continued on page 33

'The industry's shift toward vaccination for coccidiosis has totally changed the game.'

Spraycox II Debuts at IPE

A dependable tool for coccidiosis vaccination in the hatchery just got better.

Engineers at Schering-Plough Animal Health have developed Spraycox II, an updated version of the popular spray cabinet that's already in place at most large poultry companies. Hardware can also be purchased for upgrading existing systems.

Spraycox II, which made its debut last January at the International Poultry Expo, features a dual-nozzle configuration that provides even better vaccine coverage for their birds, with virtually no overspray on the hatchery floor or other equipment.

"We'd gotten a lot of excellent response from people who had used the original Spraycox machine," says Paul Townsend, the tech engineer at Schering-Plough Animal Health who developed the original machine and came up with the changes for Spraycox II.

"But some of them told us they were getting a little overspray that came through the slots on the sides of the chick boxes, and then ended up on the machine and on the floor."

The residue was noticeable due to the harmless red marking dye that's used in the Coccivac products.

What to do?

Townsend decided to revisit the location and spray angle of the nozzles. On the original Spraycox, the nozzles were centered side-by-side at the top of the machine, where they sprayed down and out toward the edges of the chick box.

With Spraycox II, the two nozzles are separated, one at each side, near the top corners of the machine. Each nozzle sprays down and in toward the middle of the box.

Townsend says the change in nozzle placement and spray angle is a big improvement. "When we spray down and in, rather than down and out, we're able to keep all the vaccine in the box," he says. "There's virtually no overspray, either on the machines or on the floor."

Better vaccine coverage, too

Besides helping maintain a tidier hatchery, Spraycox II also provides better vaccine coverage for the birds, Townsend says.

"With the new spray pattern, we're able to hit the birds that are under other birds," he explains. "In the field testing, when the chick box comes out of the Spraycox II machine, we're seeing red tint on anywhere from 95% to 98% of the birds in the box."

Townsend says that figure varies from hatchery to hatchery, depending on the types of equipment being used. Any chicks the vaccine misses end up being vaccinated anyway, since the birds ingest the vaccine primarily via their natural preening activity.

The new Spraycox II system is a snap to install. It can be set up in minutes, with no significant modifications needed in either the hatchery facility itself or in its equipment. Also, the new system operates in the same user-friendly way as the original, time-tested system.

The new sprayer system also can be installed on all existing Spraycox machines, including the earlier models introduced in the late 1990s. It also fits most of the portable expandable units. Spraycox II can be adjusted to 24 inches wide, 9 inches up and down, and up to 12 inches above the chick box, Townsend says.

Positive feedback

Feedback on the Spraycox II cabinet has been positive so far. "This new spray pattern will eliminate 50% of my worries about cocci," says Jim Gottsponder of Cobb-Vantress in Siloam Springs, Arkansas. "Whoever designed this new spray nozzle system deserves a huge pat on the back."

Paul Townsend and team, take a bow.

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 or call 508-627-6949 (US). We want to hear from you.

Williamsburg Seminar Draws Top US Decision-Makers

Decision-makers from more than 15 major US poultry companies got the latest news, insights and data demonstrating the benefits of coccidiosis vaccination at a CocciForum seminar held recently in historic Williamsburg, Virginia.

Steve Collins

Steve Collins, vice president, worldwide poultry, Schering-Plough Animal Health Corporation, reported that as of 2003, about 15% of all chicks placed in the spring/summer/fall (9% year-round) in the United States are vaccinated with Coccivac-B.

The use of Coccivac-B in the broiler market continues to grow and poultry companies are making anticoccidial-vaccine rotation programs part of their regular coccidiosis-management programs.

Graham Knight, Schering-Plough Animal Health's US production manager for coccidiosis vaccines, talked about the meticulous care and quality control that goes into producing every batch of Coccivac.

Veterinarians, nutritionists and production managers also heard how each species of *Eimeria* coccidia in Coccivac is produced in birds kept in separate, dedicated rooms, how oocysts are sterilized, checked for sporulation, counted, potency tested and dated to ensure each batch of Coccivac is effective.

Proof positive

Dr. Charlie Broussard, worldwide technical services manager, presented evidence from a major US broiler integrator that Coccivac-B renewed the sensitivity of field isolates to Clinacox.

Just two cycles of Coccivac-B in the rotation resulted in dramatic improvement in Clinacox sensitivity. In contrast, "resting" Clinacox by rotating it with ionophores or chemical/ionophore shuttle programs yielded neither consistent nor significant results, Broussard said.

Dr. Rick Phillips, director, worldwide technical services, gave two presentations — one on Coccivac-B's field performance, the other on the need to develop a long-term strategy for coccidiosis management.

During the first presentation, Phillips showed data from a major integrator. The study, which involved 156,000 vaccinated and 156,000 unvaccinated birds, compared Coccivac-B to a nicarb + narasin/narasin shuttle program in heavy broilers. Flocks vaccinated with Coccivac-B demonstrated better performance across all major production parameters compared to controls.

In a second field trial, salinomycin administered at 50 g/ton from day 17 to 28 or from day 29 to 42 had little or no negative impact on coccidiosis immunity after vaccination with Coccivac-B. Coccivac-B vaccinated groups, with or without salinomycin added to the feed, demonstrated excellent weight gain after challenge, Phillips said.

Long-term strategy

In a second talk, Phillips presented a strategy for long-term performance and efficacy. He explained the "quadrants of performance," which is a coccidiosis-control strategy that takes into account coccidial immunity, minimizes the potential for development of resistance and, ultimately, fosters maximum growth.

Producers also heard from an organic grower using Coccivac-B who has encountered no necrotic enteritis, which he attributed to a diet free of meat and bone meal.

Practical application

Dr. John Radu, worldwide technical services manager, said roxarsone can be used in the feed to enhance performance in broilers vaccinated with Coccivac-B. He presented data that 3-Nitro (roxarsone) administered from days 1 to 28 or from days 17 to 42 had no negative impact on immunity to coccidiosis following Coccivac-B vaccination. The source was a study conducted by Dr. Steve Davis at Colorado Quality Research.

Once a revolutionary idea, coccidiosis vaccination is now used by most leading poultry companies for at least part of their management program.

At 35, 42 and 47 days, weights and feed conversion ratios were significantly better in Coccivac-B vaccinates fed 3-Nitro from days 17 to 42 than in birds that received Coccivac-B alone, Radu said. In addition, roxarsone fed from days 1 to 28 had a positive impact on weight at 35 days, but the benefit declined as the birds were evaluated at 42 and 47 days of age.

MOUNTAIN OF EVIDENCE

Credibility of coccidiosis vaccination becoming 'undeniable'

The use of coccidiosis vaccines has soared in recent years as progressive poultry producers seek ways to rejuvenate worn-out anticoccidials and find drug-free disease control methods.

Now, research is validating the trend.

At the last meeting of the American Association of Avian Pathologists (AAAP) in Denver, researchers presented a mountain of evidence supporting coccidiosis vaccination.

Of particular note was a talk demonstrating the ability of a live oocyst vaccine, Coccivac-B, to restore the effectiveness of a chemical anticoccidial in a broiler trial.

"This is of huge benefit both to producers trying to restore the effectiveness of traditional anticoccidials and those who need to raise drug-free birds in response to market demand."

Major integrator's trial

The trial, conducted with a major US integrator, involved seven poultry complexes. A wide variety of in-feed anticoccidial rotation programs had been used. For one or two cycles the previous year, all programs had included the widely used chemical anticoccidial Clinacox (diclazuril).

First, litter samples were collected to obtain baseline diclazuril sensitivity information, said presenter Dr. Greg Mathis of Southern Poultry Research, Athens, Georgia, a key investigator in the study.

After collecting initial litter samples, four of the seven complexes continued their annual rotation using ionophores or chemical-ionophore shuttle programs for two cycles. The remaining three complexes incorporated two cycles of the vaccine into the annual rotation. The houses were then re-sampled.

Mathis determined diclazuril sensitivity by assessing weight reduction and coccidial lesion scores in test birds and comparing them to unchallenged controls. He then summarized diclazuril's efficacy as "good," "moderate" or "poor."

Vaccination improves sensitivity

In complexes that used ionophores or chemical anticoccidials, diclazuril sensitivity did not improve or improved little. But in the complexes that used two cycles of the vaccine in the rotation, diclazuril sensitivity improved significantly, Mathis said.

In fact, not one of the samples from houses that had used the vaccine tested "poor" for sensitivity in the study.

Further examination of the data showed that in one complex before vaccination, diclazuril sensitivity was rated "good" in only 30% of samples, but after vaccination, 100% of samples were rated "good."

In one complex where the vaccine had not been used, 25% of samples were rated as "good" for diclazuril sensitivity at the beginning of the study, but after continuing on a traditional rotation program instead of using the vaccine, 0% of the samples were rated "good," even though diclazuril had been "rested."

Results bolster early research

During his presentation, Mathis showed how the results of the trial bolster earlier investigations. As far back as 1976, a researcher showed that introducing massive numbers of drug-sensitive coccidia could replace drug-resistant coccidia.

In 1989, Mathis and associates found that they could improve the sensitivity of Amprol (amprolium) from 50% to 95% by using coccidiosis vaccination, which in this case was Coccivac-T for turkeys.

In 1994, noted coccidiosis researcher Dr. David Chapman of the University of Arkansas demonstrated that a field population of *Eimeria* was more sensitive to monensin after Coccivac-B was used. Then in 2000, another noted coccidiosis researcher, Dr. Harry Danforth of the USDA, showed that Coccivac-B use increased sensitivity to salinomycin.

In an interview after the presentation, Dr. Charles Broussard, worldwide poultry technical services manager for Schering-Plough Animal Health and co-author of the paper, said, "The earlier trials focused on the ability of Coccivac-B to restore sensitivity to ionophore anticoccidials. Based on pen trials, we thought the vaccine also would restore sensitivity to the chemical anticoccidial diclazuril, but it hadn't been proved in the real world. Now it has."

Fine-tuning vaccination

In other presentations at the AAAP, investigators provided information that will help fine-tune the use of coccidiosis vaccination.

Dr. Steve Fitz-Coy of Schering-Plough Animal Health presented evidence from an epidemiological study demonstrating "considerable similarities" in the antigenicity of *E. maxima* field isolates. This study bolsters evidence that Coccivac-B provides a very high level of protection to most of the wild strains in the field today. In other words, poultry producers can rest assured that the immunity provided from Coccivac-B vaccination will provide protection against coccidiosis.

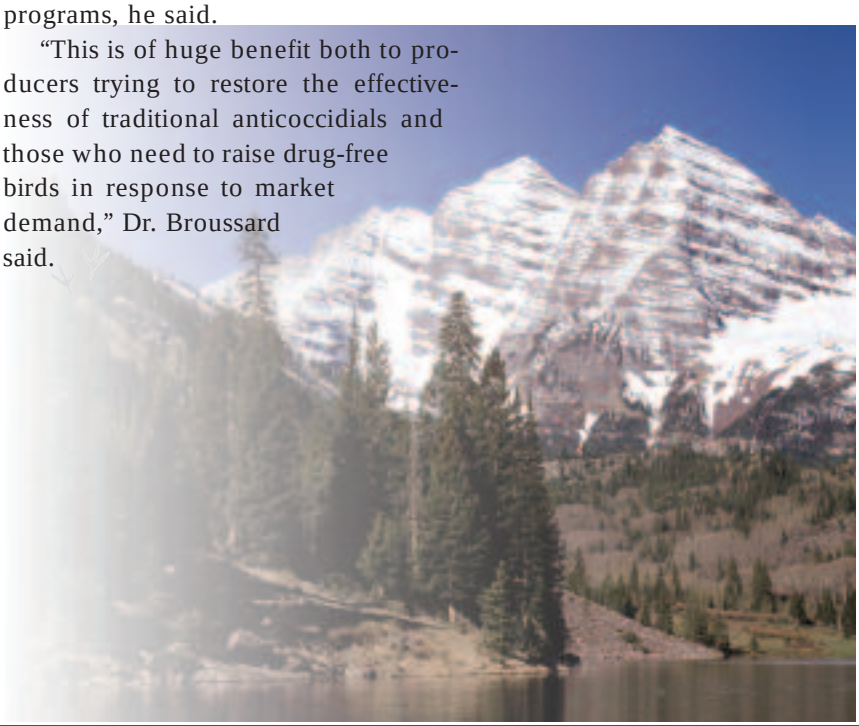
Dr. Steve Davis of the Colorado Research Center presented results demonstrating that 3-Nitro (roxarsone) has no negative effect on the immune status of birds vaccinated with Coccivac-B. Poultry producers can continue to use 3-Nitro in their program when they rotate to Coccivac-B.

Broussard said, "The credibility of coccidiosis vaccination is becoming undeniable.

"We can replace the amount of *Eimeria* resistance that's out there simply by incorporating Coccivac into the program and by making it part of a long-term control strategy. Introducing drug-sensitive coccidia into the house to replace coccidia that have lost sensitivity works."

Research confirming the usefulness of Coccivac-B in the field coupled with more information about how to "fine-tune" use of the vaccine will go a long way toward fostering development of useful, long-term coccidiosis control programs, he said.

"This is of huge benefit both to producers trying to restore the effectiveness of traditional anticoccidials and those who need to raise drug-free birds in response to market demand," Dr. Broussard said.



SUMMER HELP

Goldkist veterinarian focuses on coccidiosis vaccination to give ionophores and other drugs a much needed rest

It used to be that resting anticoccidials with rotation or shuttle programs was the only way to improve their efficacy and performance in the field. But with resistance on the increase and no new in-feed anticoccidials on the horizon, poultry companies are beginning to rethink their long-term strategy for managing this disease.

For many operations, vaccinating — not medicating — for coccidiosis is not only filling the void, but also breathing new life into in-feed products that were last seen heading for the obituary column. While in Atlanta for the International Poultry Congress, CocciForum flagged down key decision-makers at leading US poultry companies for their thoughts on this issue. Following is the first in a series of post-convention reports.

Roney: 'Any time you're not using a drug, you're resting it.'

Dr. Steve Roney, director of veterinary services at Goldkist, Inc., Atlanta, reports using coccidiosis vaccine mostly in the summer months and says it's a big help keeping resistant strains down in the house.

"Vaccination during the summer helps us lengthen the time that we can use our ionophores and chemicals," he explains. "In other words, we're placing the vaccine in at a strategic time so that we can get better control at other times when we have heavier cocci challenge from weather — times when we're using ionophores and chemicals for cocci control."

The main aim for Goldkist in implementing use of the vaccine, says Roney, was to regain the sensitivities of cocci organisms to the ionophores and other drugs they were using. And, he says, that's pretty much the way things have worked out.

"Over time, in our experimenting with the vaccine and also talking with other people who've used it, we think that is the way it's going to be increasingly used in the future — to use it in rotation throughout the year, or one time during the year, to break up the resistant cycles from the coccidiosis," he says.

Backed by science

The strategy Roney's been employing at Goldkist is backed by solid science. For example, researchers at the University of Arkansas recently wrapped up a long-term study that compared how several different rotation programs affected strains of salinomycin-resistant coccidia.

In one group, complete rest from anticoccidials for four consecutive flocks resulted in improved, but not restored, sensitivity to salinomycin.

In another group that received three different shuttles of Clinacox — Clinacox/salinomycin, salinomycin/Clinacox, or Clinacox/Clinacox — there was nearly complete restoration of sensitivity to salinomycin.

Interestingly, in still another group, when Clinacox was used alone for four consecutive flocks, the result was, again, nearly complete restoration of sensitivty to salinomycin.

Resting drugs

Roney feels this concept of "resting" drugs is becoming increasingly integral to the success of many modern poultry operations.

"Any time you're not using a drug, you're resting it," he reasons. "So you're hoping that when you come back to that drug you're going to get increased efficacy."

The veterinarian thinks there's one other plus to including a vaccine in the program.

"With long withdrawal times on

conventional cocci programs, we get the challenge of the oocysts pushed farther in the bird's life, to the point where we can't control it with chemicals or with ionophores," he says. "When that's the case, we can come in with the cocci vaccine and it'll push the challenge back earlier in the bird's life, making it easier for our standard programs to work when we go back to them."

Roney is encouraged by results he's seen so far with Coccivac.

"Based on what I've experienced in the past couple of years, I think we're on the right track. We're not all the way there yet. But with the limited amount of drugs that we have available, and seeing no new products on the horizon, I'm convinced that vaccination is going to be a huge part of our program in the future," he predicts.

Mathis continued from page 27

"The growth of Coccivac-B and the industry's recent shift toward vaccinating for coccidiosis has totally changed the game," he says. "Now you have animal health companies wanting to do trials to see how their drugs, nutraceuticals or other additives perform in a program with the vaccine. Suddenly, there are a lot of new programs and options for managing coccidiosis — and that's exciting."

For Mathis, it's almost as if the industry has wound back the clock 20 years, even though it's actually moving forward with strategic, integrated coccidiosis programs that address costs, resistance issues and consumer concerns about drugs being used in livestock and poultry production. These new mandates are also hatching some innovative research with landmark results.

"Last year's study showing how Coccivac-B can restore the efficacy of Clinacox and other anticoccidials was probably one of the most coccidiosis-significant studies I've been involved with in the last 20 years (*CocciForum*, No 7, p. 4)," Mathis says.

"Over the next 5 years, I don't think we'll see any new breakthrough products for coccidiosis, but we will see the industry learn to do a better job using the products that are available to it now. We still have a lot of work to do."

Passing it on

Mathis plans to play a big role in that education effort. He says he likes doing research that yields "practical information that poultry companies can use now" and then presenting it at industry meetings.

"If I had to pick something, I think my greatest contribution has been getting information out to the industry on how things work, and getting people to think about what they're doing so they can do a better job controlling coccidiosis," he adds. "There are a lot of new disease concerns in the poultry industry, but there's only one disease that's found in every chicken house in the world — and that's coccidiosis. It'll always be here."

No chance of coccidiosis ever being eradicated?

"There's never been a drug that could kill it all off without running into some resistance issues," he says. "Europe has tried disinfecting, but cleaning out houses can, in some ways, even make coccidiosis worse."

Mathis isn't complaining, however.

"It's frustrating that we can't eliminate coccidiosis, but I'm not sure I'd want it to disappear anyway. That would be bad for my business, and then I might have to look for a real job."

A PERFECT 10

Despite obvious differences, Amadori's premium and standard broilers have found common ground in one major area of production management — coccidiosis control

Other than ruffled feathers and feet with three pointed toes, the colorful broiler chickens raised outdoors for high-end specialty markets bear little resemblance to the stark white, big-breasted broilers produced in confinement to meet the world's high-volume demand.

'Passione di Famiglia': Founder Francesco Amadori (center) with son and general director Flavio (right) and production director Maurizio Arienti.

The differences in genetics and housing are obvious, but free-range, organic and other niche-market birds also have specific needs in terms of nutrition and animal health.

In many cases, these differences are driven by good husbandry and common sense. In others, government regulations or buyer specifications may determine which feed ingredients and animal health products producers can use.

Confronted with shifting consumer trends and the sobering possibility of not having any in-feed drugs available in the future, some innovative poultry companies have boldly added premium lines to meet growing demand for more natural products. In the process, they've discovered common ground when it comes to one major area of poultry management: coccidiosis control.

Balancing act

Amadori, Italy's second largest poultry producer, is a case in point.

The family-run enterprise founded in the 1930s now produces 80 million broilers a year, nearly one-third of which are for its aggressively promoted "Amadori 10+" product line. The simple but memorable brand name was inspired by the company's new, rigid 10-point criteria that shun animal byproducts, GMO crops and growth-promoting antibiotics in favor of vegetables, soya, mineral salts and vitamins. (See Amadori's "10 Rules of Farming.")

Day-old chicks are vaccinated in the hatchery with Paracox-5 to stimulate their natural immunity and provide lifetime protection against coccidiosis. If any medication is needed, Amadori resorts to water-soluble antibiotics to speed recovery.

The 10+ line is backed by a meticulous tracking system that allows Amadori to trace the origin of virtually every bird. All of the company's birds are bred in Italy.

Building confidence

Their two-market strategy appears to be working. Despite a depressed chick-

en market in recent years, Amadori's overall volume is at a record high, yielding a broad range of products including roasters, parts, breaded products and prepared foods, including new Buffalo wings and complete meals with side dishes.

Amadori launched the 10+ line — and the high standards that go with it — in 2001 after the BSE scare made consumers wary of eating commercially raised beef and other proteins. The 10+ line sought to build consumer confidence, satisfaction and safety while also meeting discriminating Italians' demand for high-quality food and convenience.

Still, Amadori decided to go one step further.

In 2002, the company launched Il Campese, an extension of the 10+ line. The birds meet the same 10-point criteria, but they are reared in open-air facilities with 70% of their diet made from cereal grains.

Il Campese birds are placed in buildings at a rate of 10 for every square meter, but they have ready access to an outdoor area that affords 1 square meter for each bird. Overall production costs for Il Campese birds are about 15% higher than Amadori's standard broilers, but they also command higher prices.

"Il Campese birds are carefully selected among specific breeds with reddish feathers," explains Maurizio Arienti, production director for Amadori. "Their legs are longer and thinner, and they also have a thinner, more pointed breast."

A hit with customers

According to Flavio Amadori, general director for the company, the straw-colored meat of Il Campese appeals to consumers who prefer meat with more color, firmness and consistency. In a test conducted with 800 consumers, 73% noticed the difference from the standard 10+ product and as many as 97% said they would buy it again. The specialty line now accounts for 30% of Amadori's sales.

"All of the birds in our 10+ line need to meet the same criteria and be raised under the same high standards," Amadori says. The company's efforts to reduce or eliminate drugs from production is also spilling over to its 56 million standard broilers.

For example, for about 6 months of the year, all of Amadori's birds — the 10+ line and its standard broilers — are vaccinated in the hatchery with Paracox-5. Arienti says the vaccine protects against the major strains of *Eimeria*, which causes coccidiosis, while eliminating the need to use anticoccidials in the feed. Amadori keeps its 10+ birds on the vaccine throughout the year. Standard birds receive an in-feed anticoccidial during the 6 months when they are not on the vaccine.

Added flexibility

According to Arienti, not using anticoccidials in their standard and specialty birds is a big advantage for Amadori's feed mill, which also services contract growers who supply 35% of Amadori's total production. He says the vaccine eliminates the risk of delivering medicated or unmedicated feed to the wrong location and the cross contamination in the feed mill. Using a coccidiosis vaccine also allows Amadori to be more flexible in the feeding program because the company does not have to worry about withdrawal times.

"We sell on weight, not on the number of days the

The logo of the 10+ product line is a familiar sight in Italy's supermarkets and reflects Amadori's 10 Rules of Farming listed below.

Amadori's '10 Rules of Farming'

1. Chickens and turkeys are reared with **vegetables, minerals** and **vitamins**
2. And with poultry feed complying with the **European standards** regulating the use of GMOs for human consumption (Regulation EC 49/2000)
3. **Without using animal meals** and fats
4. **Without using** growth-promoting **antibiotics**
5. **They are completely reared in Italy**
6. **All phases** from farming to slaughter **are directly checked over**
7. **Possibility of knowing the farm of origin** of each chicken and turkey
8. **All slaughterhouses comply** with ISO 9002 quality system
9. **Fast delivery** of the product right after slaughter all over Italy
10. **Certified for human consumption** (CSQA. DTP n. 030-049 Cert. 920).

birds have been alive," Arienti says. "If the market wants 1.7-kg (3.74-lb) females tomorrow, we want to market at 1.7 kg. It doesn't matter if they're 36, 37 or 38 days old. Using a coccidiosis vaccine gives us that flexibility."

Amadori: By the Numbers

- Number of broilers per year: 80 million (56 million standard, 24 million 10+)
- Tons of chicken per year: More than 220,000
- Percent of Italy's total production: More than 20%
- Employees: 5,500
- Facilities: 5 feed mills, 6 hatcheries, 6 slaughterhouses, 3 product plants
- Subsidiaries: Over 30
- Growth in volume since 1990: More than 350%

In terms of performance, Arienti says it is difficult to assess how birds vaccinated for coccidiosis compare to those given traditional in-feed anticoccidials.

"In the beginning of 2002, we had to discontinue use of all feed ingredients from animal origin," he says. "So between the ban on some protein sources and our own decision to stop using certain drugs and other additives to comply with our 10+ guidelines, we knew that live weight gain and feed efficiency would decline.

"But we have definitely seen an improvement in coccidiosis control since making the vaccine part of our program," he adds. "The anticoccidials we were using in the feed were wearing out and not working that well."

Arienti says they occasionally see what he calls "non-specific enteritis" in the vaccinated birds, but he attributes that to the absence of growth-promoting antibiotics and the anticoccidials. "If we watch our birds closely and act quickly at the early stages, we can easily control enteritis with water medication," he adds. "A lot of what we learn with 10+ line birds can be adapted for use with our standard broilers."

Being proactive and keeping a close eye on the birds is nothing new at Amadori. Despite its rapid growth, the company still owns more than 60% of its grower operations.

"Today some people think of us as marketers, but live birds are still the foundation of our business," says Amadori, son of the company's founder, Francesco. "This is a family-run business, so working closely with the birds is part of our heritage. Our goal is to find better ways to raise these birds and meet the changing needs of our customers."

The 'Last Word' on Poultry

Amadori's 10+ line and other products are aggressively promoted in TV and magazine advertisements featuring the company's affable founder, Francesco Amadori.

The ads always end with the same line: "Francesco Amadori's word of honor." The campaign evolved into more than just a slogan, however. In 2002, it was credible and powerful enough for him to be awarded Cavaliere del Lavoro (Knight of the Job) from Italy's President Carlo Azeglio Ciampi.

The Spotlight Is on Coccidiosis

Five or 10 years ago, who would have guessed that coccidiosis would be "playing" on Broadway?

In a sense, that's just what happened in December when representatives from more than 40 countries in Europe, the Middle East and Latin America. converged on Times Square in New York to learn more about managing the nutritional requirements of birds that have been vaccinated against this costly disease.

It's gratifying to see coccidiosis vaccination attract so much attention after all these years. I hope you'll take time to read the highlights of this meeting in "Gut Decisions," our special report that begins on page 6.

But really, why should anyone be surprised that coccidiosis vaccination is now the star performer in the management programs of leading poultry companies?

Increasing regulatory pressure is causing more in-feed anticoccidials to drop out of the market each year, while reducing incentive for companies to develop new-generation drugs. Furthermore, the anticoccidials that are left are showing signs of wear. Vaccinating day-old birds in the hatchery — a process that stimulates natural immunity to produce lifetime protection — is rapidly becoming the sensible alternative.

Vaccination is also proving to be more cost-effective. As you'll read in "Look at the Big Picture," which begins on page 2, performance data from an independent reporting service in the United States show that vaccinated birds perform as well or better than birds medicated for coccidiosis.

In time, we are also learning that vaccination can allow us to become more flexible and profitable with our nutrition programs. As Spain's Dr. José Ignacio Barragan notes in his article that begins on page 20, "Once liberated from the limits established by the use of a traditional anticoccidial program, poultry producers can have more freedom designing feed formulas and programs."

The rising popularity of coccidiosis vaccination has also unlocked the door to innovation. Amadori — Italy's second largest producer — is now vaccinating all of its 80 millions birds for coccidiosis 6 months out of the year. More importantly, the company's new 10+ line, which is built on more natural principles and employs coccidiosis vaccination year-round, now accounts for 30% of the company's sales. Coccidiosis vaccination is helping Amadori separate itself from the competition while meeting the growing demands of more discriminating consumers. Be sure to read their story beginning on page 34.

And let's not forget the hardware that makes all this happen. When introduced in the late 1990s, the Spraycox spray cabinet made it possible to ensure even coverage of the vaccine, which in turn ensured optimum performance. Now, an engineer in Delaware who has built his career around this contraption, decides he can do even better and unveils Spraycox II. You can read about these terrific improvements on page 28.

Getting back to our walk down Broadway…*Cats* still holds the record as the longest-running Broadway show, with an amazing 7,485 performances. If coccidiosis vaccination keeps performing the way it has in the field, it just might become a legend of its own.

John Radu, DVM
Technical Service Veterinarian

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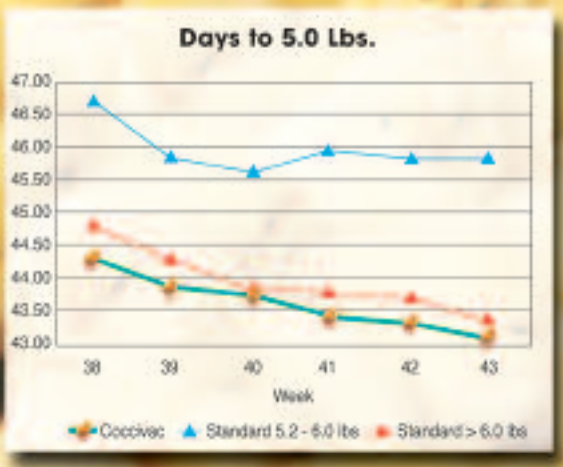
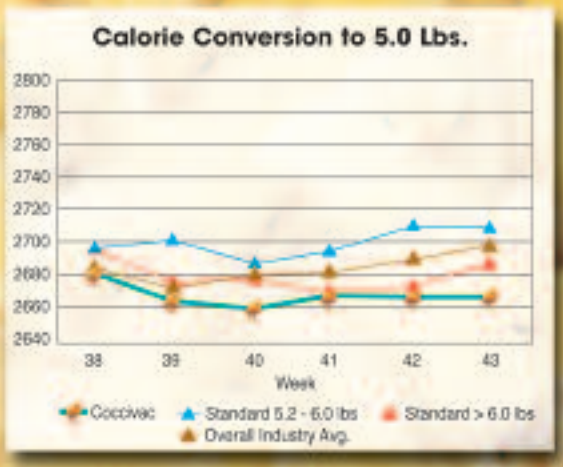
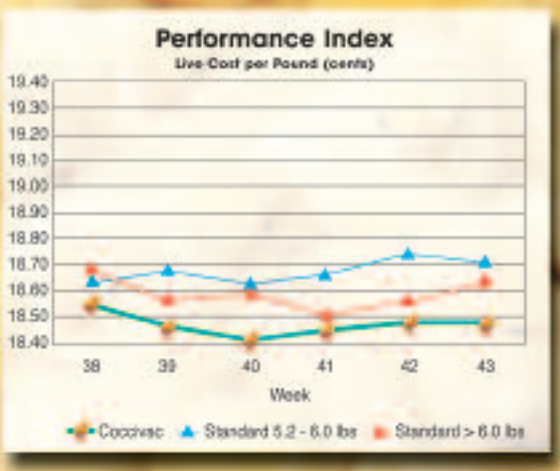
Coccivac®-B

Field Proven Performance







- **Coccivac-B vaccinated birds* demonstrated performance and weight gains that were superior to larger bird averages.**
- **Performance was also superior to the overall industry averages!**

Coccivac®-B

provides proven, long-term coccidiosis control:

- **Renews oocyst sensitivity to anticoccidials**
- **Maintains performance standards**

*6.3 lb. average bird weight.
Data on file.

Schering-Plough Animal Health
EXPERTISE...COMMITMENT...VALUE

PURE AND SURE

Licensed vaccines are the poultry industry's best assurance against extraneous pathogens

Using licensed products manufactured in an approved facility is the best assurance poultry producers have that the vaccines administered to flocks are free from unwanted pathogens.

"Producers can't afford the risk of spreading extraneous pathogens in the same vaccines they're using to prevent a disease," says Dr. Rick Phillips, director of worldwide poultry technical services for Schering-Plough Animal Health Corporation.

Knight: 'It's a crucial way to ensure that our products do not carry extraneous agents to poultry.'

"To be sure vaccines are pure, safe and effective, it's best to stick with a high-quality, biosecure product. That means a licensed vaccine," he says.

Unlicensed vaccines may be cheaper, Phillips adds, but "in the long run, it just doesn't pay off to give up quality and biosecurity for short-term savings."

'Russian roulette'

Phillips equates using an unlicensed biological product with playing Russian roulette.

"The gun is going to go off — the only question is when. You risk contaminating your flocks with some extraneous disease that could seriously set you back," says the veterinarian.

The recent outbreaks of avian flu are a perfect example, he says. "Concern about spread of the disease underscored the importance of using pure products that are tried and true."

Graham Knight, production manager at Schering-Plough Animal Health's vaccine plant in Millsboro, Delaware, agrees and points out that obtaining federal licensure for poultry vaccines is no cakewalk. (See checklist, page S4.)

USDA requires extensive testing and field trial data before granting approvals of new vaccines. It also has extensive guidelines and high standards for product manufacturing and testing.

For example, the Coccivac line of coccidiosis vaccines is made in a USDA-approved plant that follows the principles of "current Good Manufacturing Practices," or cGMPs. To initiate production of the oocysts used in Coccivac vaccines, disease-free, fully susceptible birds are inoculated with known and tested seeds that are sensitive to anticoccidials.

According to Knight, the use of these seeds ensures consistency from batch to batch of vaccine. The birds are raised in facilities dedicated to coccidiosis vaccine production. In fact, there are separate rooms for each *Eimeria* oocyst species produced, and other crucial stages of production are also segregated.

Careful handling essential

Careful handling of vaccine components throughout the production process is essential, Knight emphasizes.

Photos on pp. S1,S2 and S3 by Lisa Helfert.

Walczak (right) and technician Stacy Clavette: 'We test the product at every stage of production in adherance to strict written procedures.'

This includes mechanical removal and chemical inactivation of any possible microbial contaminants that could cause disease. During subsequent stages of production, which include blending and filling, Coccivac components are handled aseptically — under HEPA-filtered airflow — until each vial of vaccine is sealed.

Technicians Sue Toomey (front) and Elsie Alexander prepare to treat harvested oocysts with an inactivant, one of several steps taken to ensure the purity of coccidiosis vaccines made at the Millsboro plant.

"To be sure vaccines are pure, safe and effective, it's best to stick with a high-quality, biosecure product. That means a licensed vaccine."

The methods used have been tested in studies conducted jointly with the University of Delaware. In those studies, Coccivac vaccines were intentionally spiked with J virus or chicken anemia virus. "The production process cleared the vaccine of the viruses," Knight notes.

"In addition, biosecurity at the plant, such as restricted access, has always been high on the agenda because it's a crucial way to ensure that our products do not carry extraneous agents to poultry. It protects us, too. It ensures that we don't have downtime due to outside contamination," Knight says.

Extensive testing

Preventing disease-causing, extraneous agents from getting into poultry vaccines is one thing, but testing to make sure they haven't is an entirely additional layer of security provided at the Millsboro plant.

Ed Walczak, manager of quality control in Millsboro, says, "We test the product at every stage of production in adherence to strict written procedures."

Once blended, every single batch of vaccine is tested for sterility and "freedom from extraneous agents" before it goes out the door. "Overdose safety" testing also is conducted, he says.

"That's the kind of high-quality production you get with a federally licensed vaccine," Walczak says. "Manufacturers of licensed vaccines are also subject to unannounced USDA inspections and audits. The agency also does spot checks of vaccines to confirm manufacturers' testing."

Though not required by USDA, the Millsboro plant also tests all batches of Coccivac vaccines for mycoplasma. "We rest assured that our vaccines are safe and efficacious in every way," he says.

Experience counts

Phillips emphasizes that all the procedures and processes that go into making safe, quality vaccines would be meaningless without dedicated facilities and an experienced staff.

"We've spent millions upgrading the Millsboro facility in recent years. The design not only improved efficiency, it improved personnel and material flows," Phillips says.

"There's a lot that goes into producing effective coccidiosis vaccines," he adds. "There must be adequate numbers of viable oocysts in the vaccine. There must be the right balance of the different *Eimeria* species that are immunogenic. Otherwise, the final product will be compromised and vaccinated birds may not be completely immunized against all the important *Eimeria* species."

"The gun is going to go off — the only question is when. You risk contaminating your flocks with some extraneous disease that could seriously set you back."

Technician Lori McKamey rehydrates coccidiosis vaccines to field strength and uses them to inoculate plates to test for bacteria and fungi.

To accomplish all this, an experienced staff is crucial, Phillips says. At the Millsboro plant, the average staffer has nearly 20 years of experience in the field of coccidiosis vaccine production — probably more than any other production team in the field.

"Practice makes perfect," he says.

The Making of USDA-Licensed Coccivac Vaccines

- ☑ Extensive vaccine testing and field trials before USDA licensure.
- ☑ USDA-approved plant that operates to "current Good Manufacturing Practices," or cGMPs.
- ☑ Use of purity-tested seeds that ensure consistency from batch to batch of vaccine.
- ☑ Oocyst production in facilities with segregated, dedicated space for each *Eimeria* species used in vaccines.
- ☑ Purity testing of bulk material harvested for use in vaccine.
- ☑ Mechanical removal and chemical inactivation of any possible microbial contaminants that could cause disease.
- ☑ University conducted studies demonstrating that the Coccivac production process inactivates extraneous viruses.
- ☑ Aseptic handling of vaccine components during blending under HEPA-filtered airflow.
- ☑ Testing of every blended vaccine batch for sterility and "freedom from extraneous agents."
- ☑ Testing of every vaccine batch for mycoplasma, though not USDA-required.
- ☑ Testing of every vaccine batch for overdose safety.
- ☑ Testing of every vaccine batch for potency.
- ☑ Unannounced USDA inspections and audits.
- ☑ Post-production Quality Assurance (potency, safety, sterility, and efficacy) testing before any serial can be sold.
- ☑ USDA spot checks of vaccine.
- ☑ Decades of experience manufacturing coccidiosis vaccines.