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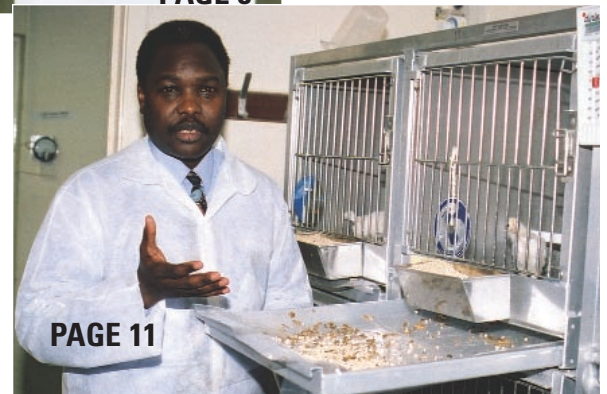
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Editors: Joseph Feeks, Marcelo Lang

Design & Production: Deborah Sottile

Contributing Writers: Diana Delmar

Steve Fox

Natalie Knudsen

Linda Leake

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NATURAL TENDENCIES

Mainstream poultry companies eye drug-free programs to address growing consumer demands and regulatory trends

Produce healthy, competitively priced chicken without using in-feed antibiotics, anticoccidials or growth promoters?

What sounded pretty far-fetched only a few years ago is steadily becoming reality for some mainstream poultry companies in the United States and other major poultry markets as they keep one eye on consumer demand and another on regulatory trends.

Smaller producers serving niche or specialty markets were the first to tap into this expanding market, using the value-added benefits of their so-called “natural chicken” to lure increasingly informed, health-conscious consumers who are willing to pay a premium for drug-free birds.

Now it appears that mainstream companies are following suit and, in some cases, actually launching “natural” lines under separate brand names.

And even if they are still using antibiotics to control some diseases, there are signs that big players in the industry are trying to wean themselves

from antibiotics before regulators force them to go “cold turkey.”

Scrutinizing antibiotic use

As it is, six anticoccidials were banned in the European Union last year and all but two growth-promoting antibiotics are now completely off limits (see *CocciForum*, No. 4). In the United States, where many of these products are still available, increasing regulatory pressure could prompt some poultry companies to reduce or eliminate some uses of drugs from livestock and poultry feeds.

For example, a recent piece of legislation, proposed by Sen. Edward Kennedy, D-Mass., aims to phase out “the routine feeding of medically important antibiotics to healthy farm animals.” Sen. Kennedy’s bill is similar to a House version that carries bipartisan support as well as endorsements from the American Medical Association and other groups.

In December 2001, a U.S. group called Keep Antibiotics Working — a coalition dedicated to reducing the use of antibiotics in animals — wrote to 50 poultry producers to advise them of three studies published in October in the *New England Journal of Medicine*, which attempted to show links between antibiotic overuse and drug-resistant bacteria found in meat and poultry products.

The coalition — which includes the Union of Concerned Scientists, Environmental Defense, the Center for Science in the Public Interest and the Natural Resources Defense Council — then asked each poultry company to “commit to eliminating the nontherapeutic use of medically important antibiotics in your production practices” and surveyed them about their

What’s Natural and What’s Not?

What exactly is “natural chicken” anyway?

As is the case with other similar terms, like “organic” and “free-range,” it depends on whom you ask. “There has been little or no headway made toward a uniform definition of what ‘natural’ really means,” says Yvonne Thaxton, editor of *Poultry* magazine.

According to USDA, the natural chicken label means “no artificial ingredients or colors were added, and that it was minimally processed.”

But what, then, does “artificial” mean? And what about “minimally processed”?

Right now there are a lot more questions on this topic than there are definitive answers.

antibiotic usage. The results of this survey have not yet been reported.

These types of pressures in the press and from consumer organizations are causing many producers to re-evaluate their current practices.

Filling the void

To fill the potential void left by antibiotics, some mainstream poultry companies are putting more emphasis on vaccines and other biological or natural controls. And, according to some reports, they appear to be making those strategies work — without experiencing big increases in production costs.

Mainstream poultry companies contacted by *CocciForum* understandably declined to comment on their marketing plans for “natural” chicken or what they were doing to combat disease without the usual arsenal of feed antibiotics and anticoccidials. It is, after all, a highly competitive industry. Even so, in talking with industry people, it seems that major producers are definitely moving in the less-drugs-is-better direction.

Yvonne Thaxton, executive editor of *Poultry* — a magazine serving the packing and food-processing industries — says recent announcements by

Tyson, Foster Farms and Perdue that they would eliminate use of some types of antibiotics will likely accelerate the movement toward more drug-free poultry.

“Like it or not,” Thaxton wrote in a recent column, “there are a lot of people who still believe that chicken are routinely fed antibiotics and hormones” in their starter and grower feeds, and so they don’t eat poultry. “Anything that poultry producers can do to change that perception will help attract more consumers.”

“Increasing regulatory pressure could prompt some poultry companies to reduce or eliminate some uses of drugs from livestock and poultry feeds.”

In an article last February about poultry companies shying away from antibiotics, *The New York Times* told its readers, “Treating a few sick birds [with antibiotics] requires treating the entire flock, and flocks often number more than 30,000. The only way for consumers to be certain the chickens they buy have not been treated with antibiotics is to purchase those labeled antibiotic-free, or organic.”



The article went on to report that some corporate consumers, including the high-volume fast-food chains McDonald's, Wendy's and Popeye's, are now refusing to buy chicken that has been treated with certain antibiotics.



“51% of U.S. consumers would like to buy “organic” meat and poultry if it were labeled as such, and 35% of those people said they would be willing to pay more for those products.”

Carving a bigger niche

Natural foods of all kinds are riding a wave of popularity worldwide. Organic foods are an example. Says Thaxton, “Although in percentage terms, organic remains a tiny fraction of the market, it is a growth area with tremendous loyalty among its core customers.”

But, besides a simple preference for more natural foods, there are a number of other factors linked to increased consumer demand for more drug-free chicken and other meats.

One is the U.S. economy, which, until recently, was booming. “Because we went through a rather affluent time,” says Susan Dosier, executive editor for foods and entertaining at *Southern Living* magazine, “many people had the economic means to be more selective in their food, health and lifestyle choices.”

No one is willing to predict, with any assurance anyway, how the current economic slowdown is going to affect sales of more drug-free chicken in the coming months and years, but industry trend-watchers say they see little sign of it slowing.

Another significant factor fueling growth in so-called natural chicken has

been greater awareness of these issues by consumers. “The impact of the Internet has been huge [on consumer decision-making],” says Rod Smith, a veteran tracker of industry trends and staff editor for *Feedstuffs*, a weekly business journal for agribusiness.

“Consumers tapping away on their laptop computers are accessing a lot of information that they never had before, including information about the ways their food is produced,” he adds. “True, a lot of it is from sources that may not always be legitimate. But the information is powerful nonetheless.”

Powerful, indeed.

A survey conducted by *Prevention* magazine found that 51% of U.S. consumers would like to buy “organic” meat and poultry if it were labeled as such, and 35% of those people said they would be willing to pay more for those products.

Good housekeeping

In order to reduce or eliminate antibiotics from their flocks, the major companies are relying on a wide array of tactics. One of those is improving ventilation in housing areas.

“Inadequate ventilation is the source of many health problems,” says *Poultry* magazine’s Thaxton. “As farms keep litter for more flocks, ammonia levels increase and flock health can be compromised.”

Improved ventilation can correct much of this problem, she points out. “But increased ventilation can cost growers more money to heat the housing areas during cold months,” she adds.

Cooling systems are also drawing more attention as producers try to reduce disease pressure. “The bigger birds grown for today’s markets must be adequately cooled to get the best performance,” says Dr. Danny L. Magee, clinical professor of avian medicine at Mississippi State University. “This requires better and more efficient cooling systems.”

Effective rodent control is another important area that health-conscious growers have to watch. Dr. Hashim Ghori, director of the poultry disease program at the Arkansas Livestock and Poultry Commission, Little Rock, stresses that rodent control is essential in raising healthy birds — with or without antibiotics.

“It’s an imperative component in any good housekeeping program,” he says. “Rodents are, of course, big carriers of *Salmonella* and other harmful bacteria. Smart growers are making effective rodent control a top priority.”

Another aspect of good housekeeping is collecting dead birds from the housing area as soon as possible, Ghori says.

“In a flock of several thousand birds, it’s inevitable there are going to be a few birds that don’t survive for one reason or another,” he adds. “To help cut down on transmission of harmful bacteria, it’s important that growers make sure those birds are picked up on a regular basis.”

Vaccination a key component

Vaccination, against coccidiosis and other diseases, is one of the most effective tools growers are using to reduce usage of antibiotics and other drugs.

Dr. Bruce Stewart-Brown, director of health services at Perdue Farms, Salisbury, Md., says his company works hard to breed birds and use practices that will help the birds ward off infection in a natural way.

“Vaccines play a very strong part in our plan to prevent disease,” he says. “We’ve always had the strong philosophy that vaccination and disease prevention should be 99.9% of our focus. Our programs are meant to prevent illness. And when we have a problem with a particular flock, we take it very seriously. We look to see if we have a weakness in our system that needs to be analyzed. We spend a lot of time with disease prevention and monitoring.”

Arkansas’ Ghori agrees that vaccination plays a pivotal role in raising healthy birds for both mainstream and specialty-market poultry companies. “Vaccines are a very effective way to help chickens develop the resistance they need to withstand challenge by pathogens they encounter in the environment,” he says. “They’re a key component.”



Ghori: ‘...vaccination plays a pivotal role in raising healthy birds for both mainstream and specialty-market poultry companies.’

Keeping coccidiosis in check

Coccidiosis control is one area where mainstream poultry companies are successfully trading in traditional in-feed anticoccidials for vaccines. Coccidiosis vaccination is allowing them to reduce or eliminate some drugs from their health programs.

According to Schering-Plough Animal Health Corporation, a company that markets two lines of coccidiosis vaccines, seven of the top 10 poultry companies in the United States now vaccinate at least a portion of their birds for coccidiosis.

For example:

- For the past 5 years, Townsends of Batesville, Ark., has been vaccinating its broilers for coccidiosis from late spring to early fall. In-feed anticoccidials are used in the other cycles. “It’s more economical to vaccinate than it is to add coccidiostats to the feed,” says hatchery manager Dave Kohler. (See *CocciForum*, Issue No. 4.)
- Peco Foods of Sebastopol, Miss., has been vaccinating for coccidiosis since

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STEPPING OUT OF THE BOX

Fine tuning, timing and management helped Pilgrim's Pride master the art of coccidiosis vaccination

Managing coccidiosis has always been a high priority for Pilgrim's Pride, a Texas-based poultry producer that last year marketed some 2.5 billion pounds of chicken in the United States and Mexico.

In January 2001, the company acquired the Harrisonburg, Va.-based Wampler Foods, including a broiler and

turkey operation in Marshville, N.C. Since then, management objectives at the Marshville site have included implementing more alternatives to in-feed anticoccidials and finding a cost advantage in doing so.

"Of all the diseases associated with broiler production, coccidiosis has the biggest impact on performance," says Dr. Beth Krushinskie, corporate veterinarian for the Pilgrim's Pride Eastern Division, based in Harrisonburg, Va. "Therefore, controlling coccidiosis is a producer's biggest opportunity to increase profitability."

Room for improvement

Controlling coccidiosis might also be a producer's greatest opportunity to improve flock health.

"Coccidiosis is not completely under control in the poultry industry and there is still a lot of room for improvement," Krushinskie says, "but our coccidiosis-vaccination program works great for us, and we believe vaccination is an effective tool for large bird grow-out operations."

The veterinarian reports seeing no major reaction problems following the use of Coccivac®-B, a live-oocyst coccidiosis vaccine. In fact, while Pilgrim's Pride does not release production figures, the Marshville operation has seen excellent bird performance while using Coccivac-B in its anticoccidial program, according to Don McIntyre, live operations manager.

"Coccidiosis is a burden that hangs over us all the time, and we are limited in the number of options available to control the disease," Krushinskie adds. "The vaccine is one 'step-out-of-the-box' tool that really helps to alleviate the problem."

Commitment to health

Pilgrim's Pride's North Carolina complex processes some 650,000 birds a week. Because of its commitment to a total health program, the operation now ranks in the top 25% for low condemnation and typically experiences 96% livability per week. The company's North Carolina coccidiosis-vaccination program didn't always run that smoothly, however.

Back in December 1999, when the operation was still owned by Wampler, it started vaccinating for coccidiosis instead of using in-feed anticoccidials.

But the results weren't pretty.

"Houses became wet and birds experienced enteritis between 2 and 3 weeks of age," McIntyre relates.

The problem was traced not to the vaccine, but to several management issues, according to Dr. John McCarty, Plantation, Fla., a consulting veterinarian for Schering-Plough Animal Health Corporation who worked closely with Wampler and now Pilgrim's Pride.

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McIntyre: 'We achieved good success with our new schedule.'

Humble Beginnings, Incredible Growth

The Pilgrim's Pride success story began in 1946 with two industrious brothers, \$1,000 cash and a \$2,500 bank note to be repaid in monthly installments.

That same year, Aubrey and Lonnie "Bo" Pilgrim sold their first chicken from a pen behind their farm store in Pittsburg, Tex. The brothers occasionally gave away as many as 100 baby chicks with each 25-lb and 50-lb. bag of Burrus Texo Chicken Feed, milled in Fort Worth, at what was then the largest feed mill in the country.

Later, the Pilgrim brothers bought back some of the grown birds to sell at a profit. Demand for the chickens grew, creating the foundation for the international vertically integrated poultry company that thrives today.

While Aubrey Pilgrim died in 1966, Bo is still involved with Pilgrim's Pride and currently serves as chairman of the board.

Under the leadership of David Van Hoose, chief executive officer, chief operating officer and president, Pilgrim's Pride has become the third largest poultry firm in the United States and the second largest in Mexico.

The firm operates five administrative and sales offices, 13 feed mills, 13 hatcheries and grow-out operations, 15 processing and slaughter plants, five further prepared food facilities and 14 distribution centers in Arizona, Arkansas, North Carolina, Oklahoma, Texas and Mexico.

A "give the customer what they want" marketing mindset has led to the development of more than 1,000 different Pilgrim's Pride products. The fresh retail line is sold regionally in the central, southwestern and western states, as

well as in northern and central Mexico. Food service and industrial products are sold nationally, with 12% of sales being exported to some 73 countries worldwide.

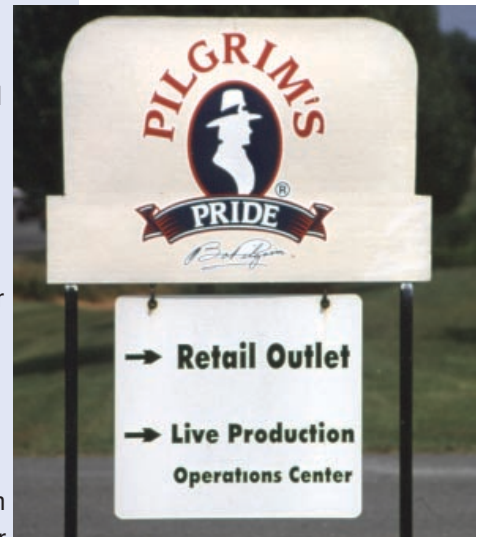
"We produce 83.2 million dozen breeder eggs for our hatcheries per year and 41 million dozen commercial table eggs per year," says Bo Pilgrim.

"We place 16 million head of chickens with our contract growers each week," he continues. "We ship over 500 18-wheelers full of finished product per day, and we sell \$10 million worth of chickens, turkeys and eggs per day to consumers and institutions."

“We place 16 million head of chickens with our contract growers each week. We ship over 500 18-wheelers full of finished product per day, and we sell \$10 million worth of chickens, turkeys and eggs per day to consumers and institutions.”

Last year, thanks to the efforts of more than 2,500 contract growers and 24,500 employees on a \$1 million per day payroll, Pilgrim's Pride processed 44 million pounds of chicken weekly in the United States, plus 11 million pounds weekly in Mexico, for a 2001 total of approximately 2.5 billion pounds. Pilgrim's Pride 2001 output also included 300 million pounds of turkey and 50 million dozen eggs.

Not only did the Pilgrim brothers make good on that original \$2,500 note, which was repaid within 5 years, the company they founded posted 2001 revenues of approximately \$2.2 billion last year, up 32% from 2000.





Tomberlin: ‘...it’s critical to vaccinate during a time period that’s both good for the birds and good for the contract growers.’

The biggest problem, McIntyre says, focused on which day chicks were released from the brood area. The company had been turning birds into the full house around day 14 during winter months and about day 11 during warm weather.

At the advice of McCarty and other Schering-Plough Animal Health veterinarians, Pilgrim’s tweaked their coccidiosis-vaccination schedule and changed to a summertime regime when birds entered the full house at a younger age.

In 2000, the North Carolina complex vaccinated for coccidiosis in August and September. In 2001 the vaccine was used from June through October, and this year from May through October. The vaccine, which contains live oocysts that are highly sensitive to the more traditional anticoccidials, helped to seed poultry houses with more manageable strains of *Eimeria*, and set the stage for more effective anticoccidial usage in fall and winter.

Seasonal considerations

“That’s not to say that coccidiosis vaccination is more effective in the warmer months,” McCarty points out. “Coccidiosis vaccine can be used in any season as long as moderately dry litter conditions can be maintained and stocking density can be managed to control the vaccination reaction. Some companies, however, find it difficult to use coccidiosis vaccine in winter because ventilation is reduced and birds are held in the partial house longer than 14 days.”

“We achieved good success with our new schedule,” McIntyre says. “The most important thing we learned was that in order for vaccination to be successful, birds have to be out of the brood chamber and into the whole house before 12 days of age.”

“For vaccinated birds, we recommend making that transition to full house between 7 and 10 days of age during warm weather,” McCarty says.

Right from the start

Under the direction of hatchery manager Doug Jones, Pilgrim’s Pride vaccinates for coccidiosis in the hatchery on day 1, using the Spraycox® cabinet — a specially designed applicator that showers birds with the vaccine. A red dye supplied with Coccivac-B helps to monitor vaccine coverage, while also encouraging preening among the chicks.

This process, McCarty explains, actually helps birds ingest the live vaccine’s oocysts that help them build natural, lifelong immunity to the costly disease — an important consideration when feeding larger birds. At its Marshville complex, Pilgrim’s Pride grows chickens to about 56 days, or an average live weight of 7 pounds per bird.

“The first vaccination dose cycle provides the greatest management challenges relative to coccidiosis control,” McCarty points out. “However, the first cycle dose seeds the litter with live oocysts, and once the litter is seeded down, it becomes easier to manage the birds during later cycles.”

Trouble-free transition

Broiler grow-out manager Terry Tomberlin helps to oversee Marshville’s 80 to 85 grower operations that produce 80,000 to 222,000 birds each in a wide variety of building styles and sizes. He says the switch to Coccivac-B coccidiosis vaccine has been virtually trouble-free since changing the coccidiosis vaccination schedule and the day on which birds go into the full house.

“Our birds have experienced few adverse reactions and very little, if any, enteritis,” he says. “Having to work through the initial problems and learning to use the vaccine to our best advantage has made us better managers. We now realize that, for our operation, it’s critical to vaccinate during a time period that’s both good for

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'COCCIDIOSIS IS ALL WE DO HERE'

Schering-Plough Animal Health Corporation's UK production facility is setting new standards for coccidiosis vaccine production and performance

The way Martin Lomurö sees it, protecting poultry against infection from a wide range of *Eimeria* organisms shouldn't be the only objective of a coccidiosis vaccine.

"As a veterinarian, I concern myself with other factors, like whether the product is sterile and free of mycoplasma and other viral, bacterial and fungal contaminants that could introduce a new disease to a flock," he says.

"I want to have a clear head about its safety, consistency and efficacy. I also want a product that's safe to humans and friendly toward the environment."

Few veterinarians in the poultry industry would argue with Lomurö's high expectations for a vaccine. What's unique about Lomurö is that he's not the kind of vet who manages health programs for one or even several poultry companies.

As the manager of quality control at Schering-Plough Animal Health Corporation's coccidiosis vaccine plant in the United Kingdom, Lomurö says his concerns extend to hundreds of progressive poultry operations in Europe, the Middle East, Africa and Latin America that have adopted this approach to vaccination for coccidiosis control with the company's Paracox™ vaccine line.

Meeting the growing demand

Lomurö smiles when asked about the changes he's seen in coccidiosis vaccine production since arriving at the UK plant in 1995.

"Back then I had only one person on staff and we shared facilities with other departments," he says. "Today I have 10 people reporting to me alone and we have a whole QC lab to our-

selves. We've also become completely self-reliant in that we hatch our own chicks for potency testing, which gives us the flexibility to retest or conduct additional tests to assure quality.

"Since being acquired by Schering-Plough Animal Health in 1997," he continues, "we've seen a lot of expansion and improvements. The company has invested heavily in our facilities and making sure our equipment and procedures are state-of-the art."

Invested heavily, indeed.



Briggs and Lomurö

Anticipating the growing demand for coccidiosis vaccine throughout the world, Schering-Plough Animal Health Corporation spent more than €10 million to increase the Paracox production capacity and ensure the highest standards for quality.

"Coccidiosis is all we do here," Lomurö says of the dedicated plant. "For me and everyone else, coccidiosis is our livelihood and we are all very quality driven. There's no room for cutting corners."

Demonstrating quality

But quality is not a feature that's readily apparent with vaccines, concedes

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From SPF Eggs to Sterile Solution: The Making of Paracox

Manufacturing biological products always presents special challenges, but Paracox is unique because chickens play a major role in the production of oocysts — the eggs of the carefully harvested precocious strains used in the vaccine to stimulate immunity and provide natural protection.

All birds used in oocyst production come from specific pathogen-free eggs, which are decontaminated with a disinfectant before being placed in an incubator. After 18 days, eggs are carefully screened for embryonic activity and the acceptable ones are transferred to one of two company hatcheries.

“We tend to get a fertility rate of about 95% to 96%, and hatchability runs about 93% to 95%,” says primary production manager Richard Wood.

‘Super-clean’ environment

All birds are fed standard starter and grower diets as if they were on a farm, but the feed is irradiated to prevent the introduction of any pathogens. No vaccines or medications are used.

“Rather than protecting birds by medication or vaccination, we protect them by keeping them in a super-clean environment,” says plant director Sue Bushnell. “The whole building is run under positive pressure, with air blowing out at every opportunity, so it would be very difficult for anything to get in there. Furthermore, all the air that flows into the primary production facility passes through special filters, so no viruses or bacteria or anything can get into the birds.”

When the chickens are old enough to produce significant volumes of fecal

matter, they are then transferred to another sterile unit, where they are artificially infected with one of eight *Eimeria* organisms. Birds are then separated by *Eimeria* species and sent to one of eight rooms — one for each species of *Eimeria* — where they are placed in pens with paper trays beneath them. The oocysts are then harvested — a process called “papering” — over the next 5 to 14 days.

The final phase

Once harvested, oocysts are held for 28 days, sporulated and then sent as an unsterile, murky suspension to the plant’s secondary production facility — sort of a “finishing phase” for vaccine production — where it’s blended, filled, packaged and distributed to more than 30 countries.

Through a unique process, the eight different suspensions are then sterilized without killing the antigens. The material is then separated and further processed into a concentrated sterile solution used to make the vaccine.

Peering into a 200-liter vat of a base agent that is blended with enough antigens to make 50 million doses of Paracox-5 vaccine, secondary plant manager Tony De-Baar reflects about the facility’s tight biosecurity and numerous quality control checkpoints at various stages.

“It’s a tedious process, of course, but we leave nothing to chance,” he says. “Electronic monitoring is also critical. There’s an alarm on virtually every door and thermostat. It’s a very tight facility, and the commitment to quality and purity is very high.”



Lomurö ‘papering’ *Eimeria* oocysts

Harold Briggs, the plant's quality assurance manager who designs the regimented systems and controls for Lomurö's QC team to implement.

"If you buy a car, you can look at it, drive it, and form your own opinion about how good it is, and you know right away if something isn't right," Briggs says. "It the same with food — you can see or smell whether it's fit to eat."

Reputation takes over

It's a whole different story with vaccines, however, where a certain degree of blind faith needs to accompany every dose. That, he says, is where a manufacturer's name and reputation take over.

"You use vaccine based on the assumption that it was made to certain specifications, it'll do what it's supposed to do, and that it's not going to harm you or your birds in any way.

"So the whole way that vaccines and other animal health products are developed, manufactured, tested, marketed and distributed has to be designed with that in mind," Briggs continues. "Somehow, there needs to be an absolute assurance that what the customer purchases is what it's supposed to be, without fail. Because with vaccines, the consequences of failure tend to be rather severe."

Having confidence in a product also helps veterinarians and producers tackle disease problems with more accuracy and authority.

"When faced with a disease problem, vets and producers can't be second guessing a product's safety or efficacy," Briggs says. "So in order for them to be sure, we have to put in place a lot of checkpoints and think carefully about their design and implementation from beginning to end.

"That's really what quality assurance is about. And that's why I say that quality assurance is a philosophy, not a department or a procedure."

As QA and QC managers, Briggs

and Lomurö are, in effect, internal auditors — meticulous, detail-oriented people who play by the book and accept no compromises. It's their job to be fussy and demanding.

"At the end of the day, I'm the guy responsible for saying whether a product meets the specifications and can be released for sale," Briggs says. "And before I make that decision, I will look at all the conditions relating to the man-



ufacture and testing of the product. I have to make sure that the product was manufactured and tested according to specifications and in compliance with good manufacturing practices. Schering-Plough Animal Health has its own set of quality standards, which in many cases are even higher than the government's. If a batch doesn't meet those criteria, it doesn't get shipped to our customers."

Consistency is the key

Consistency from batch to batch is also critical to the performance and safety of a coccidiosis vaccine, explains plant director Sue Bushnell, who supervises 70 scientists and technicians at the company's primary and secondary production facilities.

"Consistency needs to begin with the vaccine's antigens," she insists. "Every batch of vaccine that we produce, because it's come from the master strains, has exactly the same characteristic as those very first experimental isolates that were derived from the field.

Bushnell: 'Consistency needs to begin with the vaccine's antigens.'

“From a product safety standpoint, that is really, really important, because organisms can change and mutate naturally,” she continues. “But because we’re always going back and making the vaccines from these master seeds, we know that won’t happen with Paracox.”



Technician encased in a half-suit isolator used to protect the small-batch test product.

Producing coccidiosis vaccine involves infecting mature, specific pathogen-free (SPF) birds with one of eight *Eimeria* organisms, which in turn reproduce inside the birds and produce oocysts, the eggs of the next genera-

tion. The oocysts are then harvested from the feces, sporulated, sterilized, processed and blended in the right proportions to produce the Paracox line of vaccines. (See sidebar, page 12.)

While master seeds are critical for the production of all live vaccines, Bushnell says they are particularly important to the success of Paracox because the seeds are derived from what researchers call “precocious” strains of *Eimeria* — strains that were deliberately selected for their shorter reproductive life cycle and inability to damage the gut wall.

“Precocious strains of *Eimeria* produce oocysts earlier than conventional strains, but in fewer numbers,” she explains.

This unique feature helps to slow and reduce the level of oocyst infection. As a result, the vaccine stimulates the birds’ natural immunity to *Eimeria* without causing lesions and other short-term damage to the gut of the bird. This in turn means that birds vaccinated with Paracox experience no short-term setbacks in weight gain or feed conversion from the deliberate infection caused by the vaccine.

continued on page 23

Rigorous QC Standards Guard Against Mycoplasma, Other Infectious Pathogens

After Paracox antigens have been sterilized, Quality Control produces a small batch of test vaccine to make sure it’s free of viral contaminants.

According to QC manager Martin Lomurö, this series of tests, which is repeated for every antigen, is different from the plant’s sterility test and is subcontracted to the British government’s central bacteria laboratory.

“If there is a breakdown in the plant’s antigens unit during production of a specific lot, we would take blood samples from the birds and do a whole range for serological tests to make sure their status had not been compromised during the period when the antigen was down,” he explains.

“Those tests alone run from £39,000 to £50,000 (€61,800 to €79,200), but we want producers and vets to be confident they’re getting a coccidiosis vaccine that has been tested to the highest standard, free of other infectious agents and immunologically proven.”

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

Charles Broussard, DVM

Steve Fitz-Coy, Ph.D.

Lanny Howell, DVM

John McCarty, DVM

Rick Phillips, DVM

John Radu, DVM

Q. WHY IS FIELD MANAGEMENT SO CRITICAL FOR SUCCESSFUL COCCIDIOSIS VACCINATION?

A. Coccidiosis vaccines such as Coccivac are composed of live organisms that must cycle in the birds for at least 3 weeks to induce full immunity. The ability of the coccidia to cycle and the severity of the reaction will depend on house conditions. Poor house conditions can result in weak immunity or severe vaccination reaction.

Q. CAN I USE COCCIDIOSIS VACCINES AT PARTIAL DOSE?

A. No. The vaccine must be able to out-compete the wild coccidian strains in the house. If you do not start with a sufficient dose of vaccine oocysts, the wild strains may overtake the vaccine before the vaccine has multiplied to levels that can induce full immunity. Also, it is important to ensure that all birds in the flock will receive an adequate dose to stimulate fast and complete development of immunity. Always use the full dose to ensure proper cycling and protection.

Q. WHEN SHOULD BIRDS VACCINATED FOR COCCIDIOSIS BE RELEASED FROM HALF-HOUSE BROODING?

A. We recommend birds be released to full house by 10-12 days. If weather permits, releasing birds sooner may help lessen reactions, give birds more access to the feed and reduce the chances of litter eating. (For more information see article on page 8.)

Q. AT WHAT POINT SHOULD VACCINATED BIRDS BE TREATED FOR COCCI LESIONS?

A. There will be a percentage of birds (approximately 35%) with mild cocci lesions (+1 range) that should not be treated. This is normal and is needed to allow for proper cycling of the oocysts and ultimate immunity development in the birds. Typically, if there is a noticeable amount of cecal cocci (*E. tenella*), then treatment may be warranted — usually amprolium at half level for 2 days.

Q. DO BIRDS VACCINATED FOR COCCIDIOSIS NEED TO BE TREATED WITH AMPROLIUM?

A. No. Using the Spraycox machine to administer coccidiosis vaccine ensures a more uniform dose, so reactions are milder and amprolium is not needed.

*Have more questions about coccidiosis vaccination? Send yours to the editor at jfeeks@prworks.net or by fax to 928-569-2491. You'll get a personal reply from a Schering-Plough Animal Health Corporation technical service representative and we may include it in our next issue of **CocciForum**.*

THE EFFECTS OF SELECTION PRESSURE ON *EIMERIA* POPULATIONS



Rick Phillips, DVM
Director, Worldwide Technical
Service, Poultry
Schering-Plough Animal Health
Corporation

Coccidiosis of poultry is caused by intracellular protozoan parasites belonging to several species of the genus *Eimeria*. As poultry producers know, coccidiosis can significantly impair growth rate, feed utilization and flock uniformity.

Coccidia organisms have a complex life cycle. There is a portion inside the bird (endogenous) and a portion outside (exogenous) in the litter/environment.

Selection pressure

All living organisms, including protozoa, are influenced by their environment. This environmental influence is referred to in biology as selection pressure.

Selection pressure can be natural or man made. When applied to a given biological population, it can give certain species or strains in that population an advantage or disadvantage to their survival and reproductive capabilities.

All living creatures are under a constant natural selection process. In mammals, selection pressure occurs slowly over thousands of years due to the relatively slow generation time. In the rapidly proliferating world of microorganisms such as bacteria, viruses and protozoa, however, selection pressures can have a profound rapid effect on population dynamics.

To truly understand and predict the population's behavior, analysis of these populations is a quantitative discipline and mathematical models are required. Unfortunately, no specific model has been developed to predict the behavior of the *Eimeria* population in today's poultry production units.

On the other hand, there is a tremendous amount of scientific data

that enables basic predictions to be made about how *Eimeria* behave in a controlled environment with defined conditions or pressures, such as a poultry house.

Two major selection pressures placed on the *Eimeria* population in today's production facilities include host immunity and anticoccidial programs, such as live coccidial vaccines and drugs.

1. Host immunity

The immune system response of poultry to coccidial parasites is complex. Both cell-mediated and antibody immune responses are activated during a coccidial challenge; yet, the cell-mediated immune response plays a larger role in disease resistance.

The host immune system is a naturally occurring selection pressure that constantly influences the dynamics of the coccidia population in poultry houses. Less immunogenic coccidial species and strains that have the ability to evade the host immune system will have a higher survival percentage over the life of the flock. The immune response can vary greatly between different poultry breeds and/or strains. This is why the breed/strain, age and sex of the host (bird) can have a dramatic effect on the level of coccidia that is shed in a poultry house.

2. Anticoccidials

Synthetic chemicals: Synthetic chemicals, especially the highly effective ones, place strong selection pressure on coccidia populations in poultry houses.

Ironically, synthetic chemicals are too effective with respect to long-term control of coccidia populations in poultry facilities. Coccidial strains most sen-

sitive to the drug are not allowed to replicate in the gut of the bird, allowing the resistant and/or less drug-tolerant species or strains to rapidly multiply without natural competition (Figure 1).

This rapid selection for natural resistant strains prevents the continuous use of synthetic chemicals in a poultry operation. When resistance is low to an effective synthetic chemical, maximum flock performance may be realized with respect to good coccidial control.

Polyether ionophores: In contrast, polyether ionophores are not as effective in coccidia control as an effective synthetic chemical. They place less selection pressure on the coccidial population, allowing for some coccidial replication or shedding to occur.

With the ionophores, there is enough replication of coccidia to allow the host immune system to respond effectively. The long-term success of the ionophores has been due to this simple yet complex scenario.

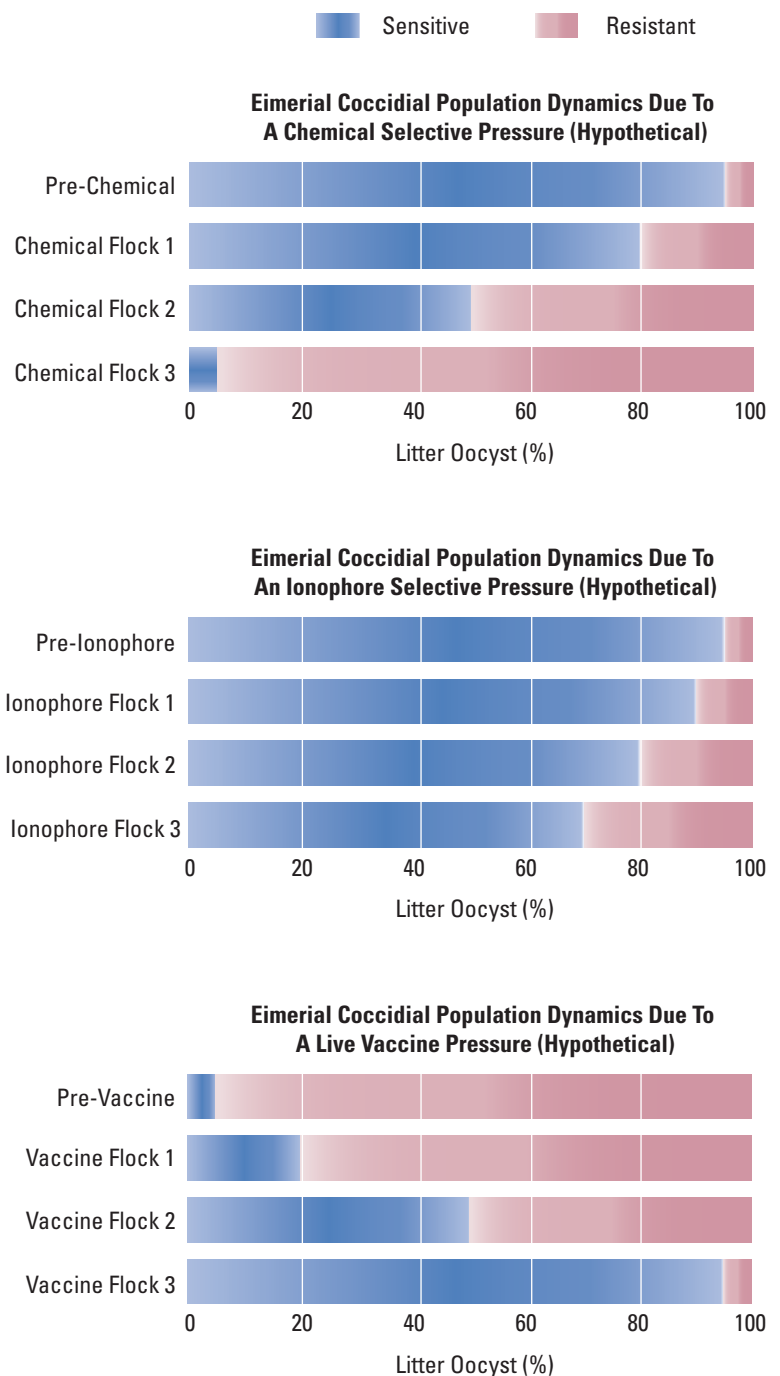
Live vaccines: Once a shift occurs in a coccidial population from drug-sensitive to drug-resistant/tolerant, it may take many years or growing cycles before the coccidial population has the opportunity to naturally shift back to its original state once the anticoccidial product is removed/rotated. However, the use of effective live, drug-sensitive coccidial vaccines shortens the time it takes for a population to shift back.

Live coccidial vaccines, by nature, place selection pressure on an existing coccidial population in the poultry house. When applied appropriately, live coccidial oocysts will replicate and replace drug resistant/tolerant field strains. Over a relatively short period of time, the coccidial population will shift to more sensitive strains.

Summary

In order for poultry integrators to maximize flock performance, a good understanding of the two key selection pressures mentioned above — host immu-

Figure 1



nity and anticoccidials — is imperative. Adding drug-sensitive, live coccidial vaccines in rotation with conventional coccidiostats will help the industry maximize product efficacy and coccidial control.

Stepping Out of the Box *continued from page 10*

the birds and good for the contract growers.”

Since implementing a warm-weather vaccination schedule into its coccidiosis control regime, the Marshville

Long: *‘Good communication with the feed mill is critical to the successful transition of a coccidiosis-vaccination program.’*



complex hasn't made any major management changes other than moving birds into full house by 12 days of age.

litter once a year,” McIntyre reports. “Half of our growers clean in the spring, the other half during the fall. The down time generally runs 12 to 14 days.”

Good communication essential

A team effort has been critical in the Pilgrim's Pride coccidiosis-control program, adds Tommy Long, feed mill manager in Marshville. He oversees ingredient purchasing, milling and delivery.

“Good communication with the feed mill is critical to the successful transition of a coccidiosis-vaccination program,” Long emphasizes. “Accidentally feeding medicated feed to a vaccinated flock could kill the vaccinal organisms and interrupt the immunization process. Even worse, mistakenly giving unmedicated feed to a flock that hasn't been vaccinated could cause a full-blown coccidiosis outbreak.”

“We're accustomed to dealing with a number of different feed formulas all the time, but there are logistics concerns we've had to work out regarding bin space for medicated and unmedicated feed,” Long says.

“Communications are also important in making certain that flocks get feed with coccidiostats according to the designated schedule.”

While Pilgrim's Pride won't comment on the exact savings associated with using a coccidiosis vaccine in its program, McIntyre says, “We find the vaccine very cost-effective compared to in-feed anticoccidials. I really believe in the product.”

“Having to work through the initial problems and learning to use the vaccine to our best advantage has made us better managers.”

“Our birds require very little medication, because we strive to manage our way out of problems,” Tomberlin says.

Sanitation is also a major priority.

“We clean our buildings and change



ADDING VALUE

“Adding value” is an expression producers frequently hear in today’s global poultry industry — and for good reason.

The competition is keen, the market is price-sensitive and international trade agreements can be volatile. Progressive poultry companies know they have to continually raise the bar for quality and consistency to win consumer confidence and to build brand and customer

loyalty. It is, after all, the only way to separate your poultry products from the many others in the meat case.

It’s not much different on the animal health side of the business. Sure, Schering-Plough Animal Health Corporation is known worldwide as a leading developer of vaccines in the poultry industry — a business we’ve been honing since we shipped our first batch of vaccine in 1921.

But like you, we’re not alone in this business. We have lots of competitors, some more formidable than others. To win your trust and loyalty, we have to keep bringing “added value” to our products.

Providing expertise and top-notch technical support is, of course, one way we try to meet that objective. By working side-by-side with our customers, conducting field trials, presenting new ideas at industry meetings and publishing information in technical bulletins, scientific journals and, of course, our own *CocciForum* magazine, we’re committed to keeping our customers on the forefront of coccidiosis management.

Perhaps less apparent to our customers is the work we do behind the scenes to ensure vaccine quality and consistency. Let’s face it: Virtually any company with a fermenter and a government license can call itself a vaccine manufacturer. However, it takes an industry leader — with its rigid guidelines for quality assurance and control that often exceed government criteria — to deliver the consistency and performance that you demand from a vaccine.

This is particularly important for coccidiosis vaccines, where plant QA/QC procedures and meticulous biosecurity need to be paramount to avoid introducing new pathogens to vaccines. Maintaining the right balance of *Eimeria* antigens is also critical to producer performance and safety.

It is for these reasons that I hope you’ll take time to read our Special Report on the intricacies of coccidiosis vaccine production and the steps we’ve taken to bring you “added value.”

Stephen P. Collins

Vice President, Worldwide Poultry

Schering-Plough Animal Health Corporation



Bowman: 'With the new spray cabinet technology, the vaccine is distributed uniformly and we're getting excellent control.'

Natural Tendencies *continued from page 7*

1998. "With the new spray cabinet technology, the vaccine is distributed uniformly and we're getting excellent control — as good or better than what we've had with any in-feed product," says live production manager Van Bowman. He adds, "Because the vaccine protects against coccidiosis for the lifetime of the bird [as opposed to a limited treatment period by programs using in-feed anticoccidials], I don't have to worry about birds breaking with disease as they get older." (See *CocciForum*, Issue No. 2.)

"Overall our production costs are up about 10%," he says, "but we're getting about a 15% premium" on the vaccine-only birds.

Results of studies comparing vaccinated birds with those receiving in-feed coccidiostats support the real-world experience reported by CP and others. In one series of studies conducted by Dr. Harry Danforth of USDA, weight gain and feed efficiency in vaccinated birds initially lagged behind those fed anticoccidials. However, the vaccinated birds eventually caught up and, by the end of the study, there was no statistically significant difference in weight or feed efficiency between the two groups, which were grown 53 to 63 days.¹ Similar results have been obtained in studies with broilers.

Still, a number of important questions remain. One is whether the demand for drug-free poultry is a growing trend or just a passing fad. Another is exactly how much growers can rely on vaccines and good housekeeping practices alone to keep their flocks healthy without in-feed drugs. And still another: What sort of profits can growers reap — over the long term as well as the short term — from raising drug-free or so-called natural birds?

Those are questions that are likely to be answered sooner rather than later by producers working hard to expand this once regarded "niche" market into a major one.

As *Poultry's* Thaxton puts it, "Looking for creative ways to increase consumption both locally and internationally sometimes means looking for big opportunities in smaller places."

Reference

¹ *Int J Parasitol*, 1998 Jul; 28 (7):1099-1109.

“Looking for creative ways to increase consumption both locally and internationally sometimes means looking for big opportunities in smaller places.”

The trend is also catching fire overseas. As reported in a previous issue of *CocciForum* (No. 1), southeast Asian poultry giant Charoen Pokphand, Bangkok, found vaccinating for coccidiosis to be an effective way to reduce drug use in its flocks.

Somboon Denvanich, a senior vice president for the company, says CP's resellers "wanted a strategy for adding value to their products." He adds, "Drug-free birds are helping our resellers reach that goal and obtain a premium price on their products."

Measuring returns

But what about the costs-versus-profit of raising birds using a coccidiosis vaccine rather than routine use of drugs?

In the case of CP, Denvanich says that finishing time for a 2-kilo (4.4 lb) vaccine-only bird is about 45 days — about 3 days more than when the company uses growth-promoting antibiotics such as zinc bacitracin and virginiamycin, and other feed antibiotics.



Denvanich: 'Drug-free birds are helping our resellers ... obtain a premium price on their products.'

Coccidiosis Trend Shows Shift Away from Drugs

Seven of the top 10 poultry companies in the United States now use a vaccine instead of an in-feed drug to control coccidiosis in at least a portion of their birds. Many smaller poultry companies are also turning to vaccination.

"In just 5 years, coccidiosis vaccination has evolved from a technique used almost exclusively by breeder producers and broiler companies targeting specialty markets to a standard practice in today's mainstream poultry companies," says Dr. Marcelo Lang of Schering-Plough Animal Health Corporation, which sells two lines of poultry vaccines worldwide.

Lang says a similar trend is emerging in Asia, Europe, Latin America and the Middle East, where either new administration methods or the licensing of new products are quickly changing the poultry industry's view of coccidiosis vaccination.

Lang credits most of the growth to technology improvements. For example, in 1997, the USDA approved Coccivac-B — a live oocyst coccidiosis vaccine that helps chickens develop natural immunity to *Eimeria* organisms — for hatchery spray administration. The specially designed spray cabinet showers day-old chicks with a coarse spray of vaccine. The chicks then preen and ingest the vaccine orally.

Significant milestone

"The spray cabinet was a significant milestone on the road to reducing drug usage in modern poultry production," he adds. "Besides reducing labor, the cabinet ensured uniform vaccine distribution, which in turn led to greater efficacy and bird performance."

In the United States alone, coccidiosis vaccine usage has increased 500% since the spray cabinet option was launched in 1997, Lang reports. Schering-Plough Animal Health expects usage to increase another 25% in 2002 as more poultry companies appreciate the practicality and value of vaccination. Coccidiosis vaccination in turkeys is also expected to surge this year with USDA's recent approval of a sister product, Coccivac®-T, for hatchery

spray administration.

"We are seeing the same trend in the broiler markets of Asia, Latin America and Egypt, where the spray cabinet is also being used," he adds.

In Europe and Israel, the arrival in 2000 of Paracox-5 — a new-generation attenuated vaccine that protects against the most economically significant species of *Eimeria* causing coccidiosis in broiler chickens — has prompted more poultry companies to use vaccination for all or part of their coccidiosis-management programs. According to Lang, the recent spray cabinet approval for Paracox-5 has resulted in even greater usage.

More growth expected

"Throughout the world but more immediately in Europe, we expect coccidiosis vaccination to grow significantly as local poultry companies respond to growing consumer demand for meat products produced without in-feed medications," Lang says.

"The BSE and foot-and-mouth disease outbreaks in Europe over the past 2 to 3 years, while not directly related to poultry, have also made consumers more concerned about what is being used in livestock and poultry feeds.

"We think this trend is also driving interest in coccidiosis vaccination and other alternatives to feed additives."

Aware of consumer attitudes in Europe, producers in other countries know it may be only a matter of time before similar concerns are expressed in their markets. As a result, Lang says, producers in the United States, Latin America and Asia are now evaluating coccidiosis vaccination as a medication alternative.

"They also want to be ready in case more in-feed medications are restricted or banned." Lang adds.



Lang: In just 5 years, coccidiosis vaccination has evolved ... into a standard practice in today's mainstream poultry companies.

Chapman Presents Data from Rotation Study



What's the optimum rotation program with a coccidiosis vaccine? Which coccidiostat should be fed when? And should it be fed in the starter, grower or both?

Those were some of the questions that Dr. H. David Chapman of the University of Arkansas tried to answer in an exhaustive, five-cycle

trial he conducted with Coccivac-B, diclazuril and salinomycin.

Chapman notes that continuous use of ionophores in chickens has resulted in a decline in efficacy due to the selection of resistant strains of *Eimeria*.

"It has been proposed that alternation of an effective drug with a different mode of action, such as diclazuril, followed by vaccination with a live vaccine containing drug-sensitive strains, such as Coccivac-B, may serve to improve subsequent efficacy of ionophores," he said. "Evidence to support this has now been obtained."

Five successive flocks of broilers were reared in floor-pens and treated with rotational programs using diclazuril, Coccivac-B and salinomycin in different combinations. A negative control group of pens did not receive any treatment, while a positive control received salinomycin throughout the five grow-out cycles. Oocysts were isolated from the litter of birds given the different treatments after the fourth flock and the ability of salinomycin to suppress oocyst production of the isolates measured.

"Salinomycin was more effective against isolates from birds that had received diclazuril, followed by vaccination or vaccination alone than against isolates from treatments that had received salinomycin for four successive flocks," he reports.

"It is proposed that use of diclazuril served to reduce the prevalence of isolates with reduced sensitivity to ionophores (clean-up) and subsequent use of the vaccine repopulated the pens with drug-sensitive strains present in the vaccine," Chapman says. "Adoption of novel strategies for the control of coccidiosis is important for the long-term sustainable control of coccidiosis."

Hatchery Equipment Update —



Dual-Nozzle Spray Cabinet Aids Hatchery Vaccination

Any product that saves time and labor is a welcome addition to the poultry industry. The newest offering from Schering-Plough Animal Health Corporation is the dual-nozzle Sprayco cabinet for the simultaneous administration of Coccivac-B and Newcastle/Bronchitis (ND/IB) vaccines.

"The biggest challenge was providing the correct dose of Coccivac at 21 ml and Newcastle at 7 ml during the one second time frame when the box passes under the nozzles," says Paul Townsend, engineer and poultry equipment specialist for the company's Poultry Business Unit.

While the nozzles may look the same to the untrained eye, there's technical wizardry behind the system.

"To ensure effective vaccination, Coccivac-B must be administered as droplets on the birds for preening and as a fine mist for inhalation," stresses Townsend.

The new ND/IB nozzle delivers the vaccine in a flat, even spray across the entire box compared with the older machines that sprayed two round patterns in a rectangular box.

"Combining products offers poultry operations added convenience while reducing labor costs and providing a single unit that saves space," says Townsend, who together with equipment technician Joe Warren logged more than 200,000 miles last year setting up and troubleshooting Sprayco cabinets throughout the U.S., Europe, Asia and Latin America.

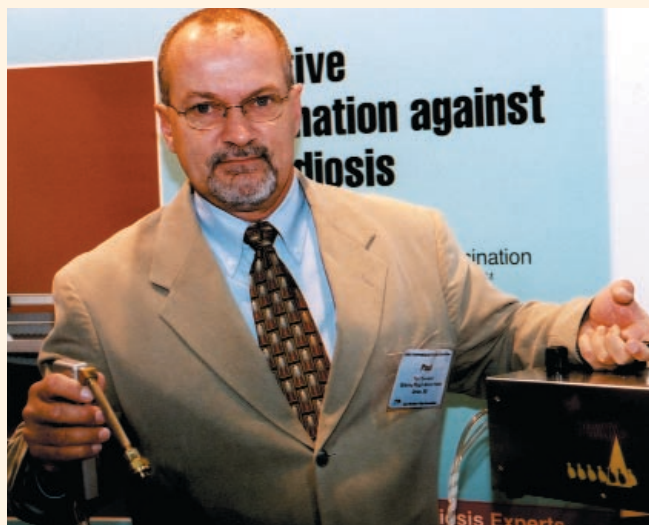
Sprayco, Jr. Provides Insurance

Schering-Plough Animal Health has also introduced Sprayco, Jr., a lightweight, handheld unit for administering coccidiosis vaccine to day-old chicks in the hatchery.

"It's an excellent backup unit that can be up and administering vaccine in 2 to 3 minutes," Townsend says. "Every hatchery should have as an insurance policy."

Sprayco, Jr., which operates manually and provides the same particle size and dosage as the on-line Sprayco cabinet, can also be used as a primary vaccination tool in smaller hatcheries or in turkey operations when poults are received.

For more information, poultry operations should contact their Schering-Plough Animal Health sales representative or 1-800-219-9286.



Townsend with Sprayco, Jr.

Coccidiosis Is All We Do Here *continued from page 14*

Keeper of the seeds

As manager of Schering-Plough Animal Health's primary production facility for Paracox, Richard Wood is the keeper of the master seeds, which are carefully preserved in a vat of liquid nitrogen. The slightest change in temperature or intrusion into the highly secure storage area is enough to trigger alarms and send technicians running.

"Anyone handling the master seeds is allowed to handle one species a day," the veterinarian says. "We also have strict time limits for harvesting oocysts from the master seeds. There's only a 15-minute window, which is much less than what we have on the oocysts used when producing the actual vaccine."

Wood notes that each *Eimeria* species has a different level of reproductive potential. Consequently, some species can be reproduced with only a handful of birds, while others might require hundreds or even 1,000.

"*Eimeria necatrix*, which goes into our breeder vaccine, is one of the species which is not very immunogenic," Wood explains. "So we need to produce a lot of it to produce the vaccine. Not only do we harvest the material over a 72-hour period, but we have to use over 1,000 birds each time — and that's just to produce 10 million doses or less."

Eimeria tenella, used in both the breeder and boiler vaccines, also presents special production challenges because technicians need to harvest both fecal matter and the guts of the infected birds.

"We've got a high level of control in all our processes," Wood concludes. "The fact that we start off with very dirty material — chicken feces — and produce a sterile, highly efficacious and safe product that's free of mycoplasma and other pathogens is really quite an accomplishment. It takes

a lot of experience to make a high quality coccidiosis vaccine."

'Most fantastic achievement'

Martin Shirley, the coccidiologist at the UK's Institute of Animal Health who helped isolate and develop the precocious lines of *Eimeria* used in Paracox, says he feels like a proud father anytime he visits Schering-Plough Animal Health's production facility.

"Back in the 1970s, when we were looking at the future and the idea of



replacing traditional anti-coccidials with a vaccine, we always hoped it would become big," he says. "But quite honestly, I don't think we really realized that the market would become so huge.

"When I visit the Schering-Plough Animal Health plant, I'm always overwhelmed by the expansion, the state-of-the-art procedures and what it's actually producing.

"Coming up with the master seeds was one thing, but I think what Schering-Plough Animal Health has done to develop the product is the most fantastic achievement," Shirley says.

De-Baar: 'It's a tedious process... but we leave nothing to chance.'



Paracox™ the **COCCIDIOSIS VACCINE** with a *green* bill of health

New Paracox-5

Most chickens have to depend on drugs to control coccidiosis. But not **Paracox** chickens!

Paracox and now new Paracox-5 for younger chickens control coccidiosis without resistance developing and they don't leave residues in the meat. Add the flexibility of no withdrawal period, no need for coccidiostats in the feed mill and it becomes obvious –

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Further information is available from:

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