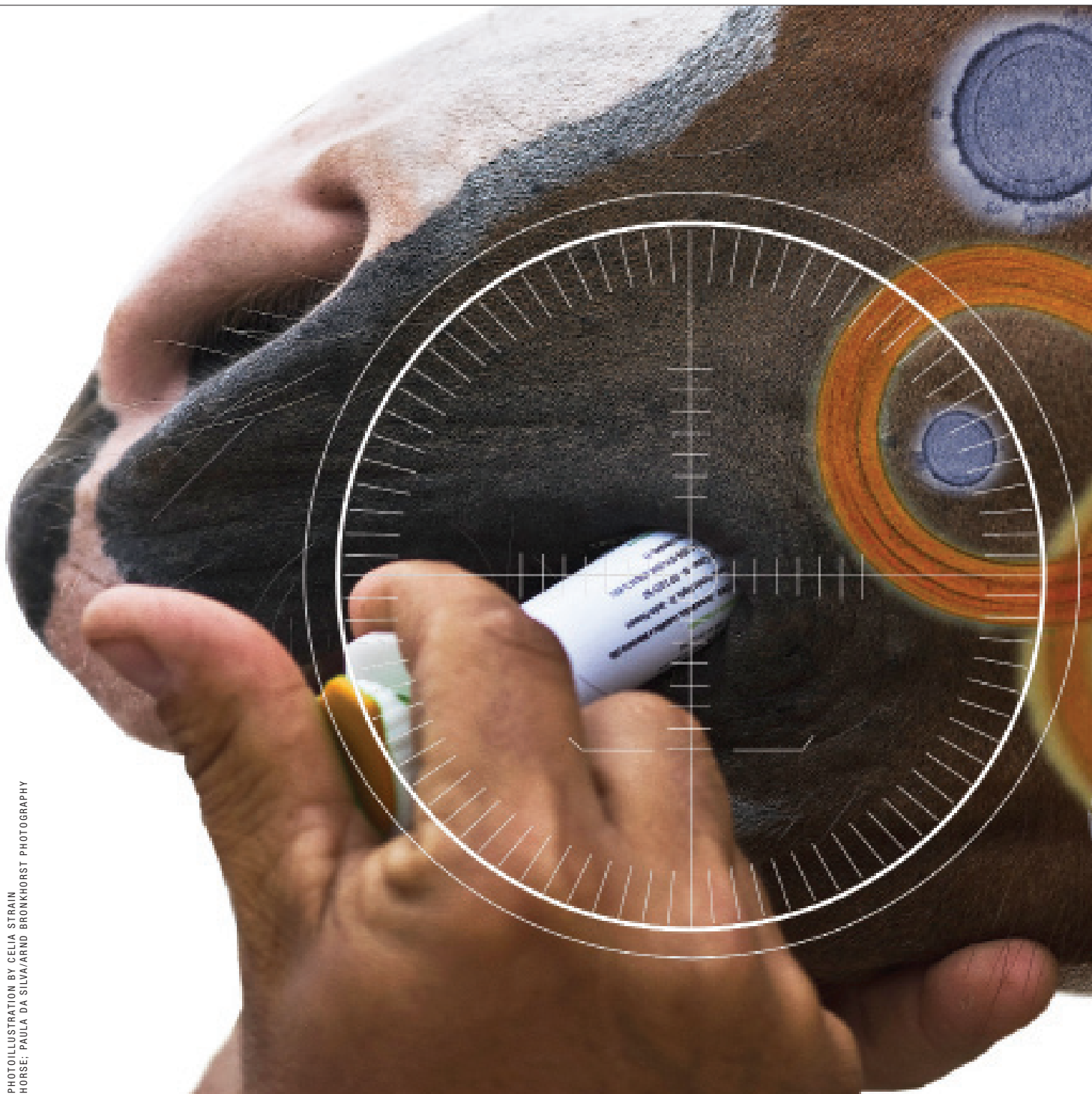


# SPECIAL REPORT THE A CHANGE



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# DEWORMING REVOLUTION INTACTICS



We must adopt new parasite-control techniques not only to protect today's horses but to benefit future generations. Here's what you need to know to do your part.

*By Christine Barakat*

**F**or the last three decades, controlling internal parasites in horses has been a fairly simple proposition: Administer a dewormer every eight weeks or so, alternating among products of different chemical classes at each treatment interval. Modern deworming products, which fall into three chemical classes—macrocyclic lactones (ivermectin, moxidectin), benzimidazoles (fenbendazole) and pyrimidines (pyrantel), are safe, effective and easy to administer. And our horses are healthier than ever. In fact, reports of parasite-related problems have all but disappeared.

But even amid these signs of apparent success, trouble is brewing.

Research has shown that indiscriminate overuse of anthelmintic drugs has allowed some parasites to develop resistance to certain chemicals, rendering some agents ineffective against specific species of worms. More worryingly, scientists warn that all agents now in use could eventually lose their effectiveness if current deworming practices continue.

At the same time, parasitologists have discovered that worm burdens vary greatly among individual horses, even within the same herd. And some horses

can carry significant numbers of parasites while remaining perfectly healthy.

Given these new facts, the traditional one-size-fits-all treatment approach, dictated by the calendar alone, is not only inadequate but actually a recipe for disaster. Instead, says Craig Reinemeyer, DVM, PhD, of East Tennessee Clinical Research, Inc., the best method of parasite control requires a two-step process, implemented on a farm-by-farm and horse-by-horse basis. First, evidence must be collected to determine which dewormers still work in a particular herd and which have been rendered ineffective due to resistance. Then, the specific horses in need of deworming must be identified and a schedule for the administration of targeted anthelmintics devised.

This momentous shift did not come suddenly or without warning. In fact, it's the culmination of more than a decade of research. But now, says Reinemeyer, "The evidence is insurmountable that our prior deworming procedures are no longer sustainable." So it is up to you to work with your veterinarian in adopting these new techniques, not only to protect your horse but for the benefit of horses everywhere. Here's what you need to know to do your part.

## A LESSON LEARNED TOO WELL

The roots of our current dilemma are found in the early days of equine parasite control. For the first half of the 20th century, the available deworming agents—carbon tetrachloride, carbon disulfide and, later, phenothiazine—weren't particularly effective and could be toxic to the horse. The modern era of deworming was ushered in with the introduction of thiabendazole in the 1960s. Like the other modern dewormers that followed, thiabendazole could be effective at relatively low doses and posed less of a toxicity risk than did previous anthelmintic products.

The modern drugs held the promise of eradicating large strongyles, a very real and serious threat to equine health at the time. As larvae, these parasites migrate through a horse's circulatory system to the mesenteric artery, the main blood vessel supplying the digestive tract. They reside within the arterial walls for several months before traveling back to the intestines, where they mature and reproduce. Large strongyles can cause such severe damage to the circulatory and digestive systems that it wasn't uncommon years ago for horses carrying large parasite loads to die from a ruptured artery or to develop colic because the blood supply to the large intestine was compromised.

But the chemical agents used for parasite control were only part of the battle plan; researchers were also studying optimal intervals for dewormer administration. Then, in 1966, two parasitologists at the University of Kentucky proposed a new protocol. After observing that the number of strongyle eggs shed by horses declines after anthelmintic treatment only to rise again after eight weeks, they concluded that deworming at eight-week intervals would be optimal. This schedule, they

decided, would interrupt the worm's life cycle, reducing the number of parasite eggs and, therefore, the opportunity for transmission to grazing horses. Over time, rotation among the available classes of anthelmintic drugs was added to the recommended interval deworming approach to delay the development of anthelmintic resistance (see "How Worms Fight Back," opposite).

The 1966 recommendations were quickly adopted by horse owners and veterinarians. And the protocol was



incredibly effective, particularly against large strongyles: "They proved to be a fairly easy target," explains Ray Kaplan, DVM, PhD, a parasitologist with the University of Georgia. "And we were extremely successful at controlling them." Within a decade of the introduction of eight-week, rotation-based deworming schedules, death or illness from large strongyle infestation was exceedingly rare.

"The eight-week deworming schedule became an ingrained horsekeeping ritual because it was a reliable method

for controlling such a deadly internal parasite," says Reinemeyer. Calendars in feed rooms were faithfully marked with deworming dates and products to be used. "It made sense and it worked," says Kaplan. "We didn't know at the time, though, what we were setting ourselves up for."

## THE RISE OF THE SMALL STRONGYLE

As it turned out, we were setting ourselves up for widespread drug resistance in small strongyles, a worm that had been living somewhat innocuously in the shadows of its larger cousin.

"Small strongyles weren't considered a significant threat at the time the old deworming programs were developed," says Kaplan. "We focused on killing the adult large strongyles, the ones able to produce eggs that contaminated pastures, and so we dewormed according to their life cycle." The small strongyle's life cycle is somewhat different, however—it includes a phase in which the larvae are encysted in the walls of the gut, for weeks or even years at a time. Once they mature, however, small strongyles can shed eggs back into a horse's environment much more quickly than large strongyles.

"[Deworming] is really an arms race between the genetic ability of a worm to adapt for resistance to a drug and our ability to kill them," says Kaplan. "Parasites with long life cycles—like large strongyles—are at a distinct disadvantage. We have time to hit them with a number of different types of drugs. If one doesn't kill them,

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the next might before eggs can get back into the environment. Small strongyles, however, have a much shorter life cycle and can shed eggs quickly after surviving one treatment, putting a new generation of resistant worms onto the pasture to infect other horses. It's the nature of the biology of the individual parasite."

A comprehensive deworming strategy to target this new and different foe was never developed, however. "We continued to deworm every eight weeks, putting tremendous pressure on small strongyles to adapt for their own survival," says Kaplan. And adapt they did: Over time, small strongyles on some farms became resistant to two classes of dewormers, benzimidazoles and pyrimidines. Today, only the macrocyclic lactones are considered reliably effective against small strongyles in this country.

## OVERCOMING RESISTANCE

So today we are confronting a situation that researchers have long suspected was coming. "We realize that parasite resistance to deworming chemicals is inevitable," says Reinemeyer. "Rotation of chemical classes was supposed to prevent that, but there's no scientific evidence that it really worked. Deworming more frequently isn't the answer either; if you keep hammering the parasites, it just puts more pressure on them to mutate faster, and that's exactly what happened. Mother Nature isn't going to let her parasites be eradicated."

This concern applies not just to small strongyles, says Reinemeyer, but to other parasites that affect horses, including tapeworms, bots, ascarids and pinworms.

Developing an entirely new class of chemical dewormers would help,

## HOW WORMS FIGHT BACK

There's a reason 40 years of intense equine deworming efforts haven't resulted in the demise of all internal parasites: They've got Mother Nature on their side. Survival to reproduce a new generation is a biological imperative for all organisms, including the parasites your horse harbors. Resistance to anthelmintics is a powerful natural phenomenon that is aided by misguided deworming practices. Here's how it happens:

Individual worms that are resistant to an agent arise spontaneously, as random genetic combinations. These individuals are extremely rare and would remain so unless given a distinct advantage compared to the other worms in the population. In anthelmintic resistance, that advantage is the treatment itself. That's because effective treatment kills susceptible worms, leaving behind only invulnerable worms.

Because only resistant worms are left to reproduce after treatment has removed susceptible portions of the population, the relative frequency of the resistance genes they carry increases in the population. And the more frequently a horse is dewormed with the resistance-prone dewormer, the greater the opportunities for exclusive reproduction by the worms with resistant genes.

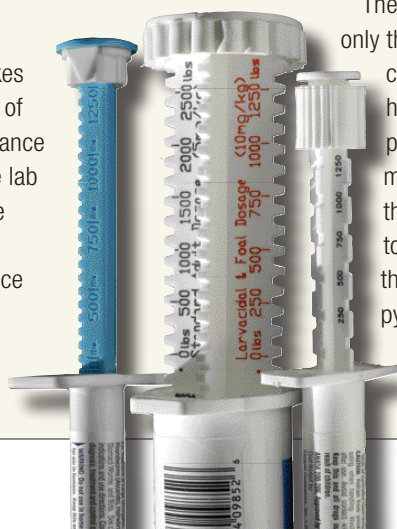
This process is incremental, and it takes dozens of generations of selection before resistance can be detected in the lab and many more before a drug fails clinically. Unfortunately, resistance genes seem to be permanent, so the trait doesn't

disappear even after use of the causative drug class halts for many years.

On the other hand, another natural phenomenon helps combat resistance: "Refugia" describes worms that would be susceptible to treatment but are out of reach when it is administered. Examples include any parasite that is on the pasture waiting to be ingested by a grazing horse or small strongyles encysted in the gut. These surviving worms are beneficial to parasite-control efforts because they can mix with the population of resistant worms and "dilute" their genes. Deworming at times of year when the refugia population is small—for instance, a very hot, dry summer in which eggs on pasture are killed by climate, or during cold winters, where the parasite stages don't develop—reduces this benefit, and frequent treatments of the whole herd inevitably reduces refugia.

In addition, rotating treatments between chemical classes of dewormers can, in theory, slow the development of resistance by exposing a single generation of parasites to different active ingredients, says Craig Reinemeyer, DVM, PhD. But scientific studies provide little evidence that rotation slows resistance. "It would be nice if it were as easy as rotation," he says, "but it's clear that it's not."

There are currently only three major chemical classes of dewormers in horses: benzimidazoles, pyrimidines and macrocyclic lactones. Of these three, resistance to the benzimidazoles is the most pervasive, but pyrimidine resistance has been reported in about 50 percent of herds.



## HELPING CHANGE HAPPEN

Transforming the parasite control habits of an entire industry requires reeducating both veterinarians and horse owners. Taking a leading role in this effort are the pharmaceutical companies that manufacture deworming products.

"I suppose it could seem somewhat strange that we are teaching horse owners to potentially decrease the number of times they deworm their horses," says Hoyt Cheramie, DVM,

**"We have a responsibility to the horses, and this is the right thing to do to protect them."**

manager of veterinary services with Merial. "But we have a responsibility to the horses, and this is the right thing to do to protect them. And, in the end, it protects our investment as a company because our drugs will be effective for longer if we utilize them in the correct manner."

Many of these reeducation efforts start with veterinarians. "[They] have been excluded from the deworming of horses for the past 25 years," explains Thomas Lenz, DVM, senior director of equine veterinary services with Pfizer. "It's not that easy for them to just jump back into it, particularly when the landscape has changed so dramatically."

Lenz has found, however, that once a veterinarian becomes involved in the process, his clients quickly adopt new techniques. "I've seen equine practitioners have great success by holding an owner-education seminar—possibly bringing in a rep from a pharmaceutical company—to introduce the concept and get the ball rolling. Then it's fairly easy to incorporate fecal egg counts and the development of a parasite-control program into the annual wellness exam."

Pharmaceutical companies are also reaching out to horse owners, in hopes they will ask veterinarians about new deworming recommendations or, if necessary, make those changes themselves. "Ideally, a veterinarian is involved, but in some areas of the country, that's just not possible," says Wendy Vaala, VMD, an equine technical service specialist with Intervet/Schering-Plough Animal Health. "In those instances, the owners can be taught to do it on their own."

In the meantime, the pharmaceutical researchers continue to search for the next generation of tools for parasite control. "We can't rest on our laurels with this new approach," says Cheramie. "It's the best we can do now, but worms respond to their environment and they may adapt to this eventually. Perhaps in 10 years we may have something we can use environmentally to control the problem, but for anything to happen we've got to keep looking."

Vaala adds that the next generation of deworming chemicals will pose a unique opportunity and a huge responsibility. "I honestly hope whichever company comes up with a new molecule makes it available by prescription only," she says. "That company will control an important resource, but they will also have the responsibility to protect it from overuse so it remains effective as long as possible."

To learn more about various pharmaceutical companies' parasite resistance education programs, visit their Web sites:

Intervet/Schering-Plough: <http://www.getrotationright.com>

Merial: <http://www.zimecterin.com/parasite/parasite.shtml>

Pfizer: [www.pfizerah.com](http://www.pfizerah.com) or [www.IDMyHorse.com](http://www.IDMyHorse.com)

but it's not the ultimate solution, says Reinemeyer: "It took 40 years for the macrocyclic lactones to come along, and I'm certainly glad they did, but in the two and a half decades since they became available, we've seen no new drug classes approved for treatment of strongyles in horses. It is extremely difficult to discover and develop a whole new class of dewormer.

"Even if someone came up with a new class of equine dewormer tomorrow," he continues, "the parasites would immediately begin to adapt, and the clock would already be ticking on resistance. The best we can do is slow down the process by abandoning the old methods of deworming and taking a more rational, targeted approach to parasite control. If we don't, we could find ourselves with no chemical options in the not-too-distant future. It's happened in other species [see "The Trouble With Sheep," page 39] and it can happen with horses."

Avoiding widespread resistance to all chemical classes of anthelmintic will require a concerted effort among all veterinarians and horse owners to change the way horses are dewormed. Here's how to get started:

► **Give up the goal of eliminating parasites.** "Nobody likes the idea of parasites living in their horses," says Reinemeyer. "But not only is the goal of a parasite-free horse impossible, it's totally unnecessary." Feral horses, he points out, are generally healthy without ever being treated for parasites. Of course, their expansive habitat allows them to graze in areas far from "roughs" covered with manure and parasite eggs, a prerogative that many modern domesticated horses don't have. "We do not need to render horses worm-free, but only get the parasite load down to a level that is not affecting their health," he says. "The presence of

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parasites is not inherently bad; in fact the immune system of the horse evolved in the presence of parasites. So parasitism is a natural state; it's only when they adversely affect the horse's health that they become a problem."

With large strongyles well controlled, Reinemeyer says, the adverse effects of parasites on a horse's health are likely to be minor. "In the modern era, small strongyles should never kill a mature horse that is properly managed and on a good plane of nutrition," he says. "As the parasite burden increases, you may see slight changes in hair coat or body condition—and you can investigate and treat those—but you're not going to go out one day and find your horse dead from parasites. It just doesn't happen that way anymore, but the fear of it has kept us stuck in old patterns."

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► **Perform fecal egg counts to identify the products that are effective on each particular property.**

Fecal egg counts quantify the numbers of various parasite eggs in a horse's manure. If counts are done for the same animal both before anthelmintic administration and again 10 to 14 days afterward, the efficacy of the agent used can be determined. If the post-treatment number of eggs is reduced by 90 percent or more, the product is effective against that type of parasite in the herd. Egg count reductions of less than 80 percent indicate that the worms on the property are resistant to the chemical.

You could save money by finding a laboratory to run fecal egg counts and learning to interpret the results yourself, but it's far easier to ask your veterinarian to perform the tests. "I'll hear people say that deworming is cheaper than a fecal egg count," says Kaplan. "But if you're deworming with a product that no longer works on your farm,

it's just wasted money. Do that once or twice a year and it becomes more expensive than a single egg count."

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Kaplan adds that the few cases he has seen of serious illness related to parasites have all been in horses kept on a regular deworming schedule without testing to make sure the products used were effective: "These owners faithfully dewormed every eight weeks, with a product that did absolutely nothing. The only way to prevent this is by monitoring the effectiveness of drugs with fecal egg counts."

► **Identify the horses who need treatment.**

Research has shown that not all horses shed parasites eggs at the same rate. In fact, in most herds a small

number of horses are responsible for the majority of pasture contamination. "We see a distinct pattern in adult horses above 4 or 5 years of age," says Martin Krarup Nielsen, DVM, PhD, a parasitologist at the University of Copenhagen in Denmark. "If you conduct fecal egg counts on a herd, you'll often find that only one or two individuals are shedding numerous parasite eggs and the vast majority are shedding minimal amounts or no eggs at all."

These "high shedders" are impossible to identify without fecal egg counts, he says: "They don't look 'wormy' at all. In fact, they are often the fattest, happiest, healthiest-looking members of the herd. But they contaminate the environment heavily with parasite eggs, leading to an increasing infection pressure." Once a high shedder is identified using a fecal egg count, there is little need for repeat testing: A horse's shedding rate remains fairly constant throughout his life. "Mature horses that have been identified as low shedders apparently exhibit the same characteristics year after year," says Reinemeyer. "One day we may be able to



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include this characteristic in gene chips, and fecal testing could become unnecessary. In the meantime, however, even if we have characterized each horse as a high or low shedder, periodically checking fecal egg counts of horses is still a good idea for purposes of routine surveillance. Knowledge of an individual horse's strongyle shedding status could dictate how a horse fits into the resident deworming program if transferred to a new barn."

Although fecal egg counts can reliably identify a constant low, medium or high parasite egg shedder, they are less useful to indicate the size of the worm burden. "We've found that at the lower end of the spectrum, horses shedding fewer than 200 eggs per gram of manure had significantly lower parasite loads," Nielsen says. "But above that, it's impossible to correlate egg shedding

with parasite load. A horse with a moderate shedding rate may actually be harboring more worms than one with a higher rate, but that doesn't matter; the purpose of basing deworming on systematic fecal egg counts is to reduce the pasture contamination and thereby decrease the infection pressure."

► **Time deworming treatments for optimal impact.**

This adjustment may be one of the hardest to accept and implement because it means many horses will be dewormed much less frequently than before. "As a working baseline, I think that every well-managed horse will be dewormed with a macrocyclic lactone, like ivermectin or moxidectin, twice a year, at about six-month intervals," says Reinemeyer. "This recommendation is essentially to maintain or achieve eradication of large strongyles. But many horses—I'd say 50 percent of most herds—won't need any additional treatments throughout the year, and the entire populations of some farms may be fine with only two treatments a year."

Reinemeyer acknowledges that this

notion will take some getting used to, "but we acknowledge individual differences in every other area of equine management, from the frequency of farrier attention to quantities and selections of rations and supplements."

Of course, it can take a bit of work to identify when each horse needs to be dewormed and with which product. "A huge number of variables come into play," says Reinemeyer, including the time of year, the age of the horse and the horse's shedding classification.

► **Use the chemical proven effective against the target parasites.**

Now, more than ever, it's important to understand which agents are most effective against particular parasites. Small strongyles, the leading parasite concern, can still be controlled with ivermectin or moxidectin. Tapeworms require a treatment of praziquantel. In younger horses, ascarids may be a concern. Anthelmintic resistance has been demonstrated in ascarids as well, so fecal egg count reduction testing should be implemented

**In most herds, a small number of horses are responsible for the majority of parasite eggs contaminating a pasture.**

DARLENE WOHLART



For a list of internal parasites that commonly affect horses go to [www.EquusMagazine.com](http://www.EquusMagazine.com)

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to identify which products are effective in your herd.

Rotation among products is still recommended for horses who require deworming for small strongyles more than twice a year. In those instances, a treatment with benzimidazoles or pyrimidines (or both at the same time) during the main transmission season can be effective—but only if those chemicals are known to still work on that property.

## PULLING IT ALL TOGETHER

The days of handy charts that show when to deworm your horse and what to use are over. “The entire point is you can’t just slap a schedule on deworming anymore,” says Reinemeyer. “There is no single prescription that’s easy to apply to all horses. It varies in each geographic region because of differences in climate that affect parasite transmission. It requires an individualized approach, worked up specifically for each property and horse.”

Fortunately, your veterinarian can make the transition to a more targeted deworming program easier. Parasitologists have developed professional education programs to enable veterinarians to take the lead throughout the industry. “It has taken a bit of convincing, since so many veterinarians haven’t been involved in deworming at all, at least since the advent of paste dewormers,” says Reinemeyer. “We are asking them to get back into an area that many of them may not be very familiar or comfortable with.”

In Nielsen’s native Denmark anthelmintic drugs are available only by prescription. This forces professional involvement and, as a result, the entire country is now deworming according to the latest guidelines. “It worked well for us, but I’m not sure that’s the answer in the United States,” says Nielsen.

## THE TROUBLE WITH SHEEP

For a cautionary tale of anthelmintic failure, horse owners need only look to the plight of sheep in New Zealand.

In the 1970s, lambs in New Zealand were typically drenched with anthelmintics seven times a year, and adult sheep were treated twice. All the animals on a farm were treated at the same time without consideration for environmental conditions or the status of each individual. In 1979, scientists reported the first instances of anthelmintic resistance among sheep and called for immediate changes to avoid dire consequences. But these warnings weren’t heeded until the late 1990s.

“The industry found itself faced with widespread resistance to every chemical class used to control parasites in sheep,” says Craig Reinemeyer, DVM, PhD, of East Tennessee Clinical Research, Inc. “Major sheep stations [ranches] have gone out of business because literally no dewormers were still effective in the flock.”

While he doesn’t see such a dramatic scenario unfolding with horses anytime soon, Reinemeyer says the equine industry has developed some of the same deworming habits that left sheep ranchers in such a serious predicament. “It’s the idea that if a little is good, a lot must be better,” he says. “It’s not true. In fact, ‘a lot’ can be much, much worse.”

Last year, a new chemical class of dewormer for sheep, called monepantel, was introduced. To avoid a repeat of the resistance problems, monepantel is available only by prescription.

“However, I see a growing awareness in the U.S. equine industry. The natural starting point is to test the efficacy of the dewormer you would typically use.”

Nielsen and Reinemeyer are currently working on a textbook for veterinarians that will help them in developing deworming protocols. Even before it is available, says Reinemeyer, most veterinarians will be able to turn to published scientific papers and presentations that keep up with the latest recommendations.

“Once you run the initial fecal egg counts to determine the efficacy of each drug and the shedding rate of each horse, it’s not all that difficult to draw up a plan based on the needs of the horse and the climate,” says Reinemeyer. “I think many veterinarians will end up integrating it into an annual wellness plan and tailor recommendations each year depending on circumstances.” Veterinarians and owners will need to be flexible, he says, because research is ongoing and recommendations may change based on new findings. “The ground is changing underneath our feet and will continue to do so.”

If your veterinarian isn’t available to help you change your deworming program, you can turn to other resources. Pharmaceutical companies are launching owner-directed education programs (see “Helping Change Happen,” page 36), and your local equine extension agent may also be able to help.

What if it all seems too difficult? “You could continue to do what you’ve always done—deworm when it’s not needed purely out of habit and with

products that may or may not be effective,” says Reinemeyer. “But that will be putting your horses at risk as well as generations of horses to come. We have a responsibility to change and get this right.” 🐏

