

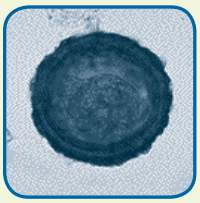





Veterinary Guide to Resistance & Parasites

How to make the Get Rotation Right deworming strategy part of your equine health wellness protocol.

MERCK Animal Health

Resistant parasites – veterinary involvement is needed now.

Horseowners unknowingly contribute to resistance.

- *Rotating brand names, not chemical classes – general confusion about when and how to use different classes of dewormers.*
- *Lack of knowledge about resistance issues.*
- *Deworming many horses more frequently than necessary.*
- *Misunderstanding about the unique properties of larvicidal treatments and how to maximize their efficacy.*
- *Underdosing their horses.*

Deworming has come a long way in the past 50 years – from products that were nearly toxic and required complicated tubing to the easy-to-administer dewormers we know now. As more horse owners recognize the value of regular deworming, past troublemakers such as large strongyles have become much less of a threat. Still, deworming is nothing to take lightly. As internal parasites become more resistant, your expertise is needed more than ever to make sure deworming programs remain efficient and effective. Only with veterinary involvement will we control parasite populations, combat resistance and get rotation right.

RESISTANCE IS REAL: MULTIPLE DRUGS, MULTIPLE PARASITES.

- No new drug class since avermectins in 1981.
- Benzimidazole resistance in cyathostomes.[1-3]
- Pyrantel resistance in cyathostomes and ascarids.[4-8,11]
- Ivermectin and moxidectin resistance among ascarids.[8,9,11]
- Early warning signs of macrocyclic-lactone-resistant cyathostomes.[10]
- Health-related issues caused by parasites:
  - ~ Ascarids (roundworms)
    - Verminous pneumonia: cough, nasal discharge, low-grade fever
    - Unthriftiness – rough hair coat
    - Intestinal obstruction/colic
    - Intestinal perforation leading to peracute death
    - Decreased performance and reduced weight gain
  - ~ Cyathostomes (small strongyles)
    - Most common in young and old horses, but can afflict any horse.
    - Younger horses: acute weight loss, acute persistent diarrhea, colic, edema, fever
    - Older horses: chronic diarrhea, chronic weight loss, intermittent colic, rough hair coat, decreased level of performance
  - ~ Tapeworms
    - Colic, ileocecal intussusception and ileal impaction
  - ~ *Strongylus vulgaris* (bloodworms, large strongyles)
    - Thromboembolic colic

Small strongyles *are considered the #1 nematode problem in horses due to their ability to encyst and burrow into the intestinal lining for up to three years.*

KEY FEATURES OF SELECT INTERNAL PARASITES.

Ascarids (roundworms)	– Typically found in foals, weanlings and yearlings. – Can cause weight loss, diarrhea, impaction colic and bowel rupture. – Larvae migrate through the liver and lungs before returning to the small intestines to complete their development. – Natural immunity develops around 18 months of age. – Transmission can occur on pasture or in confinement.
Gastrophilus sp. (horse botflies)	– Leave tiny, yellow eggs on horses' legs, mane and flanks. – Larvae enter through horse's mouth; 2nd and 3rd stage larvae attach to stomach wall. – Clinical signs can include gingival and gastric irritation and colic associated with gastric ulceration and/or rupture and gastroesophageal reflux.
Large strongyles (bloodworms)	– Fouth-stage larvae (L_4's) of *S. vulgaris* burrow into the intima of abdominal arterioles and migrate to the root of the cranial mesenteric artery. – *S. vulgaris* larvae cause arteritis and thrombi (verminous aneurysm). – Migrating larvae of *S. edentatus* and *S. equinus* cause hemorrhagic and inflammatory lesions in the liver and pancreas. – Clinical signs include weight loss, anemia and fatal thromboembolic colics. – Transmission occurs mainly on pasture.
Pinworms	– Female lays her eggs in the perianal area of the horse. – Clinical signs include tail rubbing. – Most horses develop immunity with age. – Transmission can occur in confinement or on pasture.
Cyathostomes (small strongyles)	– #1 nematode problem – can constitute up to 90 percent of horse's worm burden. – Third-stage larvae (L_3's) encyst and burrow into the mucosa and submucosa of the cecum and colon and can remain dormant for up to three years. – Clinical signs include poor performance, dull hair coat, recurring colic, diarrhea, weight loss and, in severe cases, death. – Transmission occurs on pasture.
Tapeworms	– Indirect lifecycle requires orbatid mite as intermediate host. – Clinical signs include colic and intestinal blockage.
Threadworms	– Third-stage larvae are passed in the mare's milk within a few days of foaling. – Usually the first internal parasites to affect foals. – Can cause persistent diarrhea in foals less than one month of age. – Older foals may have high fecal egg counts but no clinical signs.

Many current deworming strategies do not take into account…

- **Parasite prepatent periods/life cycles/target stage of key parasites.**
  - **~ Prepatent periods for major parasite classes**
    - – Ascarids: 10–15 weeks
    - – Large strongyles: 6–11 months
    - – Cyathostomes: 6 weeks–several years
    - – Pinworms: 5 months
    - – Tapeworms: 6–16 weeks
    - – Threadworms: 10–14 days
- **Unique properties of different drugs, (i.e., which drugs to use for which parasites).**

Chemical Class	Brand Name	Targeted Parasites
Avermectin (ivermectin and moxidectin)	**Ivermectin:** Equell™, Equimectrin™, IverCare®, Rotectin®, Zimecterin® and Horse Health Ivermectin **Moxidectin:** Quest® Gel	Ivermectin has the broadest range of activity (large and small strongyles, pinworms, ascarids, hairworms, lungworms, threadworms and bots), but does not adequately kill encysted small strongyles and is ineffective against tapeworms. Moxidectin is similar to ivermectin except effective against LL_3/L_4 stage encysted small strongyles (not labeled as effective against EL_3 stage).
Praziquantel with avermectin (tapeworm control)	**Ivermectin/praziquantel:** Equimax™ and Zimecterin® Gold **Moxidectin/praziquantel:** Quest Plus Gel	Targets all parasites according to details above, plus tapeworms.
Benzimidazoles (everything ending "-endazole," including fenbendazole and oxibendazole)	**Fenbendazole:** Safe-Guard® Paste, Safe-Guard Power-Dose, Panacur® Paste and PANACUR POWERPAC **Oxibendazole:** Anthelcide® EQ,	Fenbendazole kills large strongyles, small strongyles, pinworms, lungworms, ascarids and (at double-dose for 5 days) kills migrating large strongyles, migrating ascarids and encysted small strongyles including EL_3's. Oxibendazole is effective against large strongyles, pinworms, ascarids and threadworms, but not encysted small strongyles.
Pyrantel salts	**Pyrantel Pamoate:** Strongid® Paste, Rotectin® P, Equi-Cide®, Liqui-Care P™, TapeCare Plus™ and Pyrantel Pamoate Paste **Pyrantel Tartrate:** Strongid® C, Strongid® C2X™, Continuex™ and Equi Aid® CW-2W	Pyrantel pamoate controls large strongyles, pinworms, ascarids and to some degree tapeworms (at double-dose). Pyrantel tartrate is the basis of daily dewormers and controls large strongyles, pinworms and ascarids.

- **Fecal exams: different goals, techniques, implications and limitations.**
- **Egg Reappearance Period (ERP):** ERP is the interval between treatment and resumption of significant cyathostome egg production. Knowing the ERP for different dewormers is essential when determining the appropriate time interval for collecting meaningful fecals and when designing an effective parasite-control program. A decrease in the ERP is suggestive of developing drug resistance.
  - ~ Moxidectin ERP: 10–12 weeks
  - ~ Ivermectin ERP: 6–8 weeks
  - ~ Fenbendazole, Pyrantel ERP: 4–5 weeks
- **Refugia:** Subpopulations of parasites that are not exposed to a selection pressure (i.e., not exposed to a given drug treatment), which helps preserve a natural reservoir of susceptible genes. Parasites in refugia include:
  - ~ Larvae on pasture
  - ~ Encysted cyathostomes (when a non-larvicide is being administered)
  - ~ Parasites in untreated horses
- **Fecal Egg Count Reduction Test (FECRT):** A FECRT measures the number of eggs in a fecal egg test before and 10–14 days after deworming to determine whether or not the dewormer was effective. It defines efficacy, or indicates resistance. To calculate: (Pre-FEC – Post-FEC)/Pre-FEC X 100 = percent reduction.
  - ~ Definition varies with parasitologist, class of drug and parasite
    - – FECRT > 90% = effective dewormer
    - – FECRT < 85% = resistance
    - – FECRT between 85% and 90% = equivocal; repeat
  - ~ Avermectins/Milbemycins: < 95% to 98% = developing resistance
  - ~ Fenbendazole/Pyrantel: < 90% = resistance
- **Climatic suitability for larval development and persistence.**
  - ~ Strongyle larval development on pasture is arrested when temperatures drop below 45° F (i.e., viable larvae still persist on pasture, but eggs do not hatch and transmission of infective larval stages is arrested).
  - ~ Strongyle larvae begin to die when temperatures increase above 85° F (i.e., larval development, persistence and transmission on pasture are terminated). Larvated ascarid eggs are resistant to temperature extremes and can remain viable for > 10 years.

Why you need to get involved in deworming.

- **Veterinary involvement is the only way to ensure the health and well-being of the horse.**
- **Horse owners need expert advice to prevent resistance from becoming an issue on their farms.** They need veterinarian involvement to create an individualized deworming program that takes into consideration:
  - ~ Anthelmintic resistance.
  - ~ Identification of horses responsible for most of the pasture contamination.
  - ~ Preservation of refugia.
  - ~ Concentration of drug use during seasons when parasite development and transmission are optimal.
- **Resistance needs constant monitoring to make sure all dewormers remain as effective as possible.**
- **Targeted deworming means fewer unnecessary chemicals used; better for the environment; less chance of promoting resistance.**
- **Potential profit center for your clinic.**

HOW TO DIAGNOSE RESISTANCE.

Only veterinarians can diagnose anthelmintic resistance and identify horses that are genetically more or less resistant to parasitism.

- **Perform fecal egg count (FEC) exam prior to or at time of deworming.**
  - ~ Conduct when egg excretion is optimal: ***Wait 4+ weeks beyond the ERP of the last dewormer used*** to allow parasite eggs to accumulate to permit identification of which horses are the high vs. low egg shedders. FECs at this time reflect the immune status of the horse rather than efficacy of the last dewormer used.
  - ~ Sample sufficient horses on the premises (≥ 10%–20%). Ideally all horses should be sampled to identify strongyle shedding potential. Younger horses (< 6 yrs) are more likely to have higher egg counts and shorter ERPs and should be included in any sampling group.
  - ~ Collect freshly voided feces or per rectum (3-gram minimum).
  - ~ Keep samples cool and in air tight containers until lab analysis can be performed.
  - ~ Perform most sensitive FEC test.
    - – Sugar flotation/centrifugation recommended.
    - – Sensitivity as low as 10 epg.
    - – Increased chance of finding tapeworm eggs.
- **Repeat FEC 10–14 days post-deworming.**
  - ~ Pre- and post-treatment FEC exams should be repeated whenever a new class of dewormer is introduced during a 12–18 month period.
- **Calculate the percent reduction in FEC: (Pre-FEC – Post-FEC)/Pre-FEC X 100.**
  - ~ FEC should decline by 90%–98% depending on the class of anthelmintic used (i.e., expect ≥ 90% reduction following pyrantel or fenbendazole and ≥ 95%–98% reduction following any macrocyclic lactone).
  - ~ Each horse acts as its own control.

Resistance needs *constant monitoring to ensure all dewormers remain as effective as possible.*

20% OF THE HORSES ON PASTURE SHED 80% OF THE PARASITE EGGS. ARE 80% OF HORSES ON PASTURE BEING DE-WORMED MORE OFTEN THAN NECESSARY?

Help your clients **Get Rotation** *Right*… regain control of deworming strategies.

EVIDENCE-BASED APPROACH…ANSWER THREE QUESTIONS FOR A FARM OR GROUP OF HORSES.

1 WHICH ARE THE RIGHT HORSES?

- **Perform fecal egg counts on all horses.**
  - ~ Perform an FEC on all new arrivals and administer a larvicide prior to turning out on pasture.
- **Identify types of parasites present** (Merck Animal Health parasite management DVD's help educate your staff and technicians in strategic deworming).
- **Rank parasite egg shedders based on fecal exams** *(low, moderate, high).*
- **Deworm the herd based on results.**

  Low egg shedding potential: *Treat an average of 2 to 3 times per year.*
  - ~ Deworm at least once every 6 months during peak transmission times (i.e., spring and fall using a larvicide treatment that targets migrating large strongyle larvae).
  - ~ Ensure that one of the larvicidal treatments used above is also effective against encysted third-stage small strongyles. **PANACUR® POWERPAC** is the only anthelmintic licensed to kill all stages of encysted small strongyles, including the early-third-stage larvae (EL_3's).
  - ~ Incorporate a tapeworm treatment in at-risk horses and a boticide for all horses in the fall. In high-risk areas, deworm for tapeworms twice a year. In Southern climates, a boticide may need to be given biannually.
  - ~ If indicated, add another anthelmintic treatment during the period of peak transmission in your region. Administer the additional treatment based on the ERP of the larvicidal treatment last used.

ESPECIALLY FOR FOALS

Young foals are generally more susceptible to parasites than adult horses because of their immature immune systems. And those parasites can do a lot of damage – such as persistent diarrhea, colic and stunted growth. Here are some steps to follow for deworming foals.

1. *Deworm the mare for threadworms within 12 to 24 hours after foaling. This parasite is transmitted to the foal via the dam's milk.*
2. *Deworm the foal for ascarids (roundworms) starting at 6 to 8 weeks of age. Ascarids are the most significant foal parasite and can cause depression, respiratory disease, stunted growth, diarrhea, constipation and potentially fatal colic.*
3. *Continue deworming for general parasite control every two months.*
4. *Incorporate tapeworm and boticide treatment for all foals in the fall.*

The **Get Rotation** *Right* program

The right dewormer, at the right time, for the right horse.

Moderate egg-shedding potential: *Treat an average of 3 to 4 times per year.*

- ~ Follow the recommendations for the low shedders.
- ~ Add two additional treatments during the main parasite transmission season for your part of the country: Those additional treatments might include single- or double-dose pyrantel and oxibendazole if they are still effective on the farm. Administer non-larvicide treatments at intervals coinciding with their ERP.

High egg-shedding potential: *Treat an average of 5 to 6 times per year.*

- ~ Follow the recommendations for moderate egg shedders.
- ~ Add another larvicide treatment during high transmission periods (i.e., summer in the North; winter in the South).
- ~ Add an additional non-larvicidal treatment during the "off season" (low-transmission season) in your area.

2 WHAT IS THE RIGHT DEWORMER?

- **Return to the farm at least 10 to 14 days after deworming to perform a FECRT on at least 10–20 percent of horses.** Be sure to target those horses with positive pretreatment egg counts.
- **Determine whether dewormer is still effective.**
- **Identify any resistance issues.**

3 WHAT IS THE RIGHT TIME?

- **Determine which drug and treatment interval to use based on results.**
- **Use the Merck Animal Health strategic deworming Rx pads to write a customized deworming schedule for each patient.**

NON-CHEMICAL PARASITE-CONTROL STRATEGIES:

- **Rotate pastures if possible.**
- **Cross-graze pastures with ruminants.**
- **Remove manure from pastures and paddocks.**
- **Harrow pastures only during hot, dry periods and keep horses off for several weeks.**
- **Consult extension agent regarding proper composting techniques.**

GET ROTATION *RIGHT*

Help more horses. Create a profit center.

- Ultimate goal of increasing health and welfare of the horse.
- Ongoing involvement also helps you monitor horses' health throughout year.
- Client is more targeted and efficient with dewormers and spends less money on product.
- You create a practice profit center.

PERFORM FECAL EGG COUNT EXAM:

Cost of FEC = $_____ x Number FEC/year/horse _____ = $_____ /horse

Number of horses in practice area = _____

Estimated NEW Practice Profit Center = $_____

Recommend PANACUR® POWERPAC.

- Administer one 57-gram syringe per 1,250-lb. horse (10 mg/kg) for 5 consecutive days.
- Controls all stages of small strongyles, including the important early third stage (EL_3), along with large strongyles, pinworms and roundworms.
- 98% effective in killing encysted EL_3's.
- Proven safe even after a single dose as high as 1,000 mg/kg and doses as high as 50 mg/kg for up to 15 consecutive days.
- Safe for use in foals.

Contact your Merck Animal Health or distributor sales representative, or call 1-800-521-5767, to order.

Support from Merck Animal Health helps you explain **Get Rotation** *Right* strategic deworming to your clients.

UTILIZE MERCK ANIMAL HEALTH CLINIC SUPPORT TOOLS.

- FEC collection bags.
- Client brochures.
- Strategic deworming Rx pads.
- Weight tapes.
- Content for clinic to client newsletter.
- RFD-TV Educational DVDs on parasite management

ONLY WITH YOUR INVOLVEMENT WILL WE CONTROL PARASITE POPULATIONS, COMBAT RESISTANCE AND **GET ROTATION** *RIGHT.*

MAKE THE GET ROTATION RIGHT DEWORMING STRATEGY PART OF YOUR EQUINE HEALTH WELLNESS PROTOCOL.

Contact your Merck Animal Health or distributor sales representative, or call 1-800-521-5767, to learn more.

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GET ROTATION RIGHT STRATEGIC DEWORMING

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