



Reducing Parasite Resistance on Equine Operations Using a Comprehensive Whole Farm Approach

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“By now virtually every equine veterinarian in this country knows that regularly scheduled, across the board deworming is a bad idea. And I know many horse people do as well. But how many people have acted on this information and changed their approach to parasite control. Not nearly enough.” - Dr. Martin Nielsen, DVM< PhD, DECK, DACVM quoted in Equus Magazine

Indiscriminate use of dewormers has caused an alarming increase in resistant equine parasites. Cases of resistant small strongyle parasites are being reported worldwide. Many horse owners contribute to the development of resistant parasites by deworming horses at frequent intervals, year-round and may be using products that are totally ineffective on their farm. Adoption of new deworming practices can decrease the proliferation of resistant parasites and maintain the effectiveness of the products that are available.

The Penn State Extension equine team obtained a \$146,000 Sustainable Agriculture Research and Education (SARE) grant which was used to develop a program designed to increase farm managers' knowledge about parasite resistance, reduce the use of de-wormers, and document parasite burdens and anthelmintic efficacy on Pennsylvania horse farms.

Education

In order to empower horse owners to make changes in their deworming program, it is important to provide clientele with the knowledge and skills necessary to be confident they are making good management decisions. The project team, composed of Extension Educators, veterinarians, farm owners, and the project consultant, Dr. Martin Nielsen, DVM, PhD, PEVPC, DAVCM, determined curriculum content and developed the educational materials for a comprehensive parasite management short course, *Managing Equine Parasites Using a Whole Farm Approach*. In 2015 and 2016, the short course was offered at six locations in Pennsylvania. Topics included: parasite types, biology and behavior; the science of resistance; the importance of establishing a “non-resistant” refugium; conducting and using fecal egg counts; classes of de-wormers; the danger of short interval de-worming; pasture management and composting as a tool to reduce parasite burdens; and the effects of temperature, rainfall, pasture rotation and manure handling practices on parasite development.

In 2015 and 2016, 221 farmers attended one of 6 short courses offered statewide. 100% adopted at least one practice to reduce parasite burdens, 92% adopted two or more practices. Participants reported a moderate to large increase in knowledge about: parasites and their life cycles (94%); resistance development (91%); fecal egg counts and strategic de-worming (88%); and pasture and manure management as tools to reduce parasite burdens (88%). 94% of the participants reported that they planned to use fecal egg counts as a basis for their de-worming program; 85% planned to use pasture and manure management practices to reduce parasite exposure.

Research

The research portion of the project was designed to document small strongyle parasite fecal egg shedding on Pennsylvania farms and evaluate de-wormer efficacy. The data collected enabled farm managers to develop farm-specific strategic de-worming practices.



The farm partners met at predetermined sites and conducted fecal egg counts on all horses on the farm in order to monitor egg shedding and identify low and high “shedders”. Anthelmintic efficacy was determined by conducting pre and post de-worming egg counts for the products that were provided. Although no farms were prevented from participating in the project, only those farms with a minimum of three horses that were moderate to high strongyle shedders pre-treatment were included in the treatment efficacy assessment. Since lack of monitoring equipment is an obstacle to conducting egg counts, participants utilized microscopes and supplies strategically placed in Extension offices. Trained Extension staff provided assistance and ensured that protocol was followed.



Results

A major goal of the project was to increase knowledge of parasite biology and management utilizing an integrated approach that included monitoring egg shedding in horses and adopting farm management practices that could reduce parasite burdens. Monitoring egg shedding in all horses on the farm would increase confidence in the value of surveillance based deworming practices. As a result, horse owners would strategically de-worm horses, resulting in a reduction in the use of de-wormers.

In 2015 and 2016, owners and managers of 74 horse farms, representing 711 horses on farms representing 23 Pennsylvania counties enrolled as partners in the research project and reported the following impacts that the project had on their farm operation:

- 100% stated that they were able to identify the high shedders on their farm.
- 98% were able to identify the horses that had good immunity against small strongyles.
- 98% were able to determine the effectiveness of the de-wormers they used.
- 86% were able to reduce the use of de-wormers.
- 92% stated that the project reduced their fear of parasites.
- 100% stated that the project increased their confidence in surveillance based deworming.
- 97% stated they planned to conduct fecal egg counts on new horses.
- 74% took steps to improve pastures to reduce grazing near manured areas.
- 36% removed manure from pastures.
- 69% eliminated harrowing pastures or restricted harrowing too late fall.

Anthelmintic Reduced Efficacy

In order to monitor egg shedding and identify low and high shedders, the farm partners and Extension staff met every 8 to 12 weeks to conduct fecal egg counts. De-worming efforts were focused on horses with moderate to high small strongyle egg contamination potential. Reduced efficacy of anthelmintic occurs at the farm level and was determined by conducting pre- and post-de-worming egg counts on all horses on the farm and averaging the results. For the purpose of the study, only data collected from farms that had a minimum of 3 horses that were at the threshold of moderate to high strongyle shedders (generally 300 to 500 eggs per gram) was utilized to determine anthelmintic efficacy. Reduced efficacy is indicated when de-wormers fail to reduce egg shedding by at least 90% for pyrantel and benzimidazole and 95% for Ivermectin.

In 2015 and 2016, 74 farms participated in the study. Many of the farm managers discovered that their horses did not shed any small strongyle eggs or were low shedders during the monitoring period. Of the qualified farms that had a minimum of 3 horses that were moderate to high shedders, 76% showed reduced efficacy when dewormed with pyrantel and 95% showed reduced efficacy when dewormed with fenbendazole. This would



indicate that there is significant resistance to these products on the Pennsylvania farms that participated in the project. Ivermectin showed 100% efficacy on all qualified farms.

Data from 53 farms was used to determine the reduction in use of dewormers and economic savings obtained through reduced dewormer purchased. Prior to participating in the project, the 53 horse owners dewormed 1,992 times per year. Using surveillance-based deworming principles, deworming was reduced to 727 times a year – a reduction of 1,265 times. The cost of each deworming was set at \$7.23. This figure was determined by averaging the cost of the dewormers in the three major drug classes - pyrantel, fenbendazole and ivermectin. The total financial savings for the 53 farms was \$9,145.95. There are currently 216,000 equine in Pennsylvania. If only 10% of Pennsylvania horse farms followed these methods, the savings in product cost would be more than \$388,000/year.

Table 1. Efficacy Results for Pyrantel, Fenbendazol, and Ivermectin on Pennsylvania Horse Farms

	2015	2016	Total
NUMBER OF FARMS IN THE STUDY	52	22	74
NUMBER OF HORSES IN THE STUDY	467	254	711
PYRANTEL PAMOATE			
*Farms that had no horses at de-worming threshold	14 27%	5 23%	19 26%
** Farms at threshold that de-wormed with pyrantel	38 73%	17 77%	55 74%
***Qualified farms (farms with 3 or more horses that were moderate to high shedders)	20 38%	9 41%	29 39%
****Farms showing reduced efficacy	16 80%	6 67%	22 76%
****Farms showing intact efficacy	4 20%	3 33%	7 24%
FENBENDAZOLE – (5 mg/kg)			
*Farms that had no horses at de-worming threshold	28 54%	8 36%	36 49%
*Farms at threshold that de-wormed with fenbendazole	24 46%	14 64%	38 51%
**Qualified farms (farms with 3 or more horses that were moderate to high shedders)	11 21%	10 45%	21 28%
***Farms showing reduced efficacy	11 100%	9 90%	20 95%
***Farms showing intact efficacy	0 0%	1 10%	1 .5%
IVERMECTIN			
*Farms that had no horses at de-worming threshold	23 44%	5 23%	28 38%
*Farms at threshold that de-wormed with ivermectin	29 56%	17 73%	46 62%
**Qualified farms (farms with 3 or more horses that were moderate to high shedders)	13 44%	9 41%	22 30%
***Farms showing reduced efficacy	0 0%	0 0%	0 0%
***Farms showing intact efficacy	13 100%	9 100%	22 100%

*Horses that were not shedding eggs or were low shedders (less than 300 eggs per gram) were not dewormed but were monitored every 8 to 12 weeks for egg production.

**Horses were dewormed when they reached the threshold of 300 to 500 eggs per gram or higher. Farm managers were encouraged to consult with their veterinarians and had input into deworming decisions.

*** Data on product efficacy was obtained from qualified farms that had a minimum of 3 horses that were moderate to high shedders utilizing protocol established for the NALMS study.

****Product efficacy was determined by conducting pre and post deworming fecal egg counts on all horses on the farm that were moderate to high shedders and documenting egg shedding reduction as an average for all horses. Pyrantel and fenbendazole was reported to have reduced efficacy if egg shedding reduction was less than 90%; ivermectin was reported to have reduced efficacy if egg shedding reduction was less than 95%.

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Conclusion

What we have learned to date is:

- Most Pennsylvania horses in the study shed no or very low numbers of strongyle eggs. Most of the low shedders remained consistently low throughout the monitoring period. High shedders tended to remain high and needed to be strategically dewormed.
- There is reduced efficacy and appears to be significant resistance to pyrantel and fenbendazole on the large majority of evaluated Pennsylvania farms.
- Do to the high level of product resistance discovered on PA equine operations, it t is critical for horse owners to use strategic deworming methods and a comprehensive whole-farm approach to reduce the rate of resistance development.
- The farm managers that participated in the study were willing to adopt changes to their parasite management program when they were provided with the knowledge and tools necessary to make those changes.
- Farm managers and horse owners are extremely willing to participate in projects and research that benefits their horses and the equine community. In spite of the large time requirement necessary to complete the project, 74 of the initial 76 farm partners completed the project.
- The bond of trust that is generated in working together and the strong relationships that develop along the way is priceless.

Comments from our Farm Partners:

What was the most important thing you learned from this project?

- *How important fecal egg counts are and what dewormers work for the various parasites & which don't work for us.*
- *That doing fecal egg counts is easy & I can do them myself & will in the future..*
- *Don't spread manure in fields till grazing is complete for the year.*
- *The importance of not over de-worming to prevent drug resistance.*
- *Which horses are high & low shedders and how to avoid parasite resistance to dewormers.*
- *Cleaning up the pastures work*

For parasite control in the future what do you plan to do?

- *Rotate fields. Graze multiple species.*
- *Continue doing egg counts, only administer wormers when needed & improve grazing practices*
- *Only de-worm when counts are high enough & de-worm for bots& tapeworms after the frost.*
- *Continue monitoring fecal counts, use sacrifice areas more, improve pasture quality.*
- *If microscopes are available at the Extension office I will continue to schedule fecal egg counts.*
- *Do fecal egg counts at the farm.*
- *Follow this model*

Any additional comments:

- *This was a very worthwhile venture on many levels. The well-being of my animals. Savings. Making the most of my pastures. EDUCATION IS GOOD!*
- *What an awesome project! Can't wait to share with students*
- *We have already shared the information we've learned with our horse club at a monthly meeting & others would like to try this.*
- *I found this project very effective and important. Thank you! An exceptional Extension program.*

Comments from our consultant Dr. Martin Nielsen, DVM, PhD, DEVPC, DAVCM published in *Equus*, a national equine magazine:

“I am currently involved in a project in Pennsylvania, where the Extension service received a three year (SARE) grant to disseminate information about surveillance-based parasite control programs. The group reached out to me to help them implement a plan and I was happy to travel to educate Extension officers in various regions around the state on how to do egg counts and direct horse owners toward the best practices. This initiative and energy will change a lot of things in that state for the better. I think that could be a fabulous model for other states. If Pennsylvania can do it, why not Kentucky? Why not every state?”

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