



INTEGRATED PARASITE MANAGEMENT FOR LIVESTOCK

LIVESTOCK SYSTEMS GUIDE

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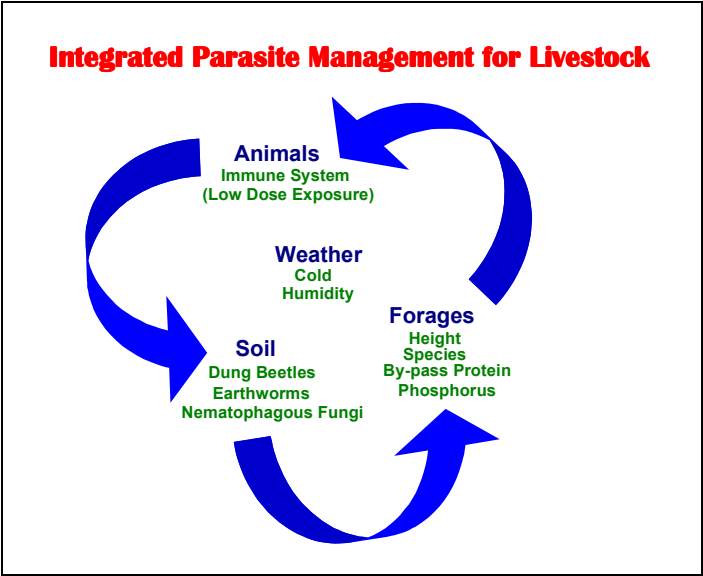
Abstract

Internal parasites can be a major problem for producers. With parasites developing resistance to all dewormers and more farmers producing livestock by "natural" methods, there is interest in looking for alternative ways to managing parasites problems. Management is the most important thing to consider. The whole system affects internal parasites. Nutrition and pasture management can help prevent problems by improving the health of the animals. There are soil organisms that kill or prevent the development of internal parasites. Strategic deworming means planning the timing when deworming is done. This can also be an important part of any management scheme. Little is known about the effectiveness of any alternative dewormer. Changes will have to done slowly while observing their outcome.

Introduction

Internal parasites are considered by some to be one of the most economically important constraints in raising livestock. Confinement and pasture-based animals are almost certain to be exposed to worms at some point in their life. Animals raised on the dry and arid rangelands are much less likely to be infested. But if these animals are brought to the more humid climates east of the Rockies, worms will be a major problem for these animals.

Most producers are aware of the problems that worms cause, which range from decreased productivity of their animals to death. Animals are usually routinely dewormed with different commercial chemicals, by owners using a variety of deworming schedules. Every



dewormer on the market has had some resistance built up to it by the internal parasites that infest livestock. This resistance means that not all the worms are killed during deworming. The surviving worms pass that genetic resistance on to offspring.

The growing concern about the resistance of internal parasites to all classes of dewormers has

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caused people to look for alternatives. As dewormers lose their effectiveness, the livestock community fears increasing economic losses from worms. Much attention both in the research community and on the farm is being devoted to discovering ways to prevent and treat internal parasites without relying on heavy doses of chemical dewormers. Many people claim this treatment or that control measure works, but there are more questions than

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answers. There is no simple alternative way of preventing or treating worms. By looking at the whole farm as an interrelated system, it becomes apparent that there are parts of the system that can be managed to decrease internal parasites and their effects. These management adjustments not only postpone the day when chemical controls no longer work, but they also may decrease costs and increase the overall health of the animal.

Nutrition

Nutrition plays a major role in how well animals are able to overcome the detrimental effects of internal parasites. In fact, the signs of parasitism can often be used as a symptom of some other problem, usually poor nutrition. In an article in the *Journal of the American Veterinary Medical Association* in 1943, researchers showed that sheep placed on a high plane of nutrition were able to reduce their worm burden significantly and many of the sheep were even able to cure themselves (1).

By-pass Protein

Researchers in New Zealand have been studying the effects of by-pass protein on parasitized sheep (2). They have found that by increasing the amount of protein that is not

degraded or broken down in the rumen, animals lose less weight than those animals that were not fed the increased level of by-pass protein. These researchers used fish meal as their source of by-pass protein. However, there are forages that also have an increased level of by-pass protein because they contain tannins. These include birdsfoot trefoil and lespedeza. The protein in native warm season grasses also has a higher level of by-pass protein.

Phosphorus

There is also research that shows that when the phosphorus level of the diet was at a level of .28% phosphorus on a dry matter basis, the weight gain of lambs infected with parasites was increased by 40% over those lambs fed a low (.18%) phosphorus level diet (3).

Pasture Management

Management of animals, pastures and any loafing areas is key to reducing the amount of internal parasite problems in livestock. An understanding of the life cycles of the different parasites within the whole soil-plant-animal system will help show the interrelationships between these three components. Managing internal parasites is just like managing fleas in dogs and cats. The major part of the parasite life cycle is outside of the animal. This point will help the producer to choose management strategies that reduce parasite levels on his or her farm and decrease the usage of chemical dewormers. The same principle is used in integrated pest management for vegetables and other crops.

Many farmers closely monitor their animals but pay little attention to the plants and soil. Pasture contamination by infective larvae is the primary factor to deal with. If you start with an understanding of the interrelationship between the animal, the plants it eats and the soil on which those plants grow, then it becomes clearer how parasites infect the animal and how they can be managed so as not to cause as many problems. Everything a farmer does to his or her animals, including the grazing management,

affects the manure, which affects the animal's environment. For example, animals that continuously graze a pasture eat the grass into the ground, while contaminating the soil with so many parasites that nothing outside of regular deworming with chemicals will control them. By using controlled grazing methods that allow pastures to rest and soil life to function well, contamination can be reduced. This reduction occurs because soil organisms, including earthworms, dung beetles, and nematophagous fungi will destroy or keep a lot of the parasite eggs and larvae from developing. Keeping the grass in a more vegetative stage, and tall enough to provide the animal with adequate forage, will provide better nutrition to keep the animal healthier, strengthening the immune system to prevent the adult worms from producing eggs. Parasites do not cause as much harm to a healthy, well nourished animal. The parasites that are present will not deplete the host as much as in an animal that is malnourished. Parasite loads affecting wildlife generally do not cause the death of the host, because the parasites need the host to survive. The same principle applies to livestock.

Pasture contamination can be reduced through management. Livestock will avoid manure piles and the grass surrounding them. This behavior also helps them avoid eating larvae. The height of the pasture sward can affect parasites. The majority of worm larvae crawl only one inch from the ground onto plants, so not allowing animals to graze below that point will cut down on a lot of infestation. This is one reason sheep tend to have more problems with internal parasites. They eat much lower to the ground than cattle do, picking up higher numbers of larvae. Therefore, it is important to monitor grazing sheep closely so they don't graze too low. Larvae migrate from the manure no more than 12 inches from the manure pile. If livestock are not forced to eat close to their own manure, they will eat fewer larvae.

With sheep and goats, the most important time to control pasture contamination is during the

periparturient rise, which is the sudden release of infective larvae and eggs within the ewe's intestinal tract. This occurs right after lambing, and is due to the ewe and doe's immune system becoming temporarily less effective. By treating animals at this time, the exposure to newborn and young lambs (those most susceptible to parasites) is minimized.

Other ATTRA Materials of Interest

Assessing the Pasture Soil Resource
Matching Livestock & Forage Resources
Meeting the Nutritional Needs of Ruminants on Pasture
Nutrient Cycling in Pastures
Rotational Grazing
Sustainable Pasture Management
Beef Farm Sustainability Checksheet

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Good grazing management includes the use of clean pasture to minimize re-infection. Clean pasture is pasture that has not been grazed by the host animal (in this case sheep and goats) for 12 months, and therefore is not contaminated with worm larvae. It may be new pasture, pasture grazed by livestock such as cattle or horses which do not share parasites with sheep (goats do share parasites with sheep), or pasture that has been hayed, renovated, or rotated with row crops. There is some killing of parasites on pasture during the winter due to freezing and thawing; however, snow cover insulates the larvae. Summer is the time in the Southern states when most larval kill will occur on pastures. Sunlight will kill them, and this occurrence can be used to determine which pastures can be used in the fall and into the winter. Grazing down to 2-4 inches from the ground allows more sunlight to get to those larvae and increases their chances of drying out and being killed.

Warmth, oxygen and moisture are the three most important things that increase the chances that larvae will survive on pasture (4). Knowing when your pastures are apt to be driest and

coldest will help you manage them better for parasite control. Enclosures such as "Alternative Approaches to Managing Small Ruminant Gastrointestinal Nematode Parasites" discuss pasture management in more detail. Also enclosed is an article that discusses the deworming effects of certain plants, such as plantain. The plantain must be young for the animals to eat it readily as it loses palatability when it becomes mature.

Cleanliness is a defense against parasites. Feed troughs and water sources located where they can be contaminated with feces will increase the chances of livestock infestation. This is only one reason not to water directly from ponds, or to allow animals continuous access to water sources. Feeders should be cleaned and elevated. Calving and lambing areas, as well as other holding areas, should be clean and dry. Prevent the transmission of infestations from new arrivals to the herd or flock by deworming them before arrival and again three weeks later.

Sheep and goats are infested by the same species of worms. Cattle are mainly infested by other species. The cattle parasite of most concern is *Ostertagia ostertagi*, the brown stomach worm. The barber pole worm, *Haemonchus contortus*, is a stomach worm that can severely affect sheep. Enclosed is an article that discusses the life cycle and infective larval stages of worms.

Immunity

While it is usually neither possible nor advisable to completely eliminate internal parasites in sheep or other livestock, reduction of parasite load can be achieved. Many people have found, and research has shown, that adult animals rarely need to be wormed (4). Most animals develop immunity against internal parasites, though not to the level that is developed against viruses and bacteria. This immunity keeps the

parasites from reproducing but rarely kills them. An example of an effective parasite control program can be found in Tennessee. Dennis Onks, superintendent of the Highland Rim Experiment Station in Springfield, Tennessee, has not wormed the adult cattle on the farm in eight years. They are wormed at weaning and then not again. They have never shown any signs of internal parasites and their condition is excellent. These animals are on a high plane of nutrition, have a low stress level, and are strictly culled on production. All these things work together to produce an animal that shows no signs of internal parasites.

It is the young animal whose immune system is not fully mature and the animal whose immune system is compromised by disease, inadequate nutrition, or other stress, that is most adversely affected by worms. Animals brought from western rangelands, for example, where the arid conditions keep parasites from surviving, have no immunity and can easily be overwhelmed by worms.

Every farm is different. The parasite load of the animal depends on many variables – such as stocking density, time of year, the reproductive state of the animal, etc. Good nutrition plays a big part in how well the animal's immune system mounts the proper defenses, and in the

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animal's overall ability to tolerate the presence of some worms. Healthy and well-nourished animals will be able to develop resistance and resilience to worms and other parasites much better than thin animals that do not have good availability of quality feed (3). Resistance is the ability of an animal to prevent the establishment and maintenance of a parasite population within the gastrointestinal tract. Some individuals and some breeds show more resistance to parasitic infection than others. Research to identify characteristics in such

The three most important things for larvae survival:

- Warmth
- Oxygen
- Moisture

individuals is a hot area. Culling susceptible animals can take advantage of this. Resilience is the ability of an animal to reduce production loss during a parasite infestation. Both of these traits are being looked at as ways of selecting animals that will be less susceptible to parasite effects. Animals that possess some genetic resistance or resilience can still be infected with worms. Therefore, you must keep in mind that this is just one more measure that will help control worm problems, not a cure by itself.

Soil Organisms

There are several soil organisms that can have an impact on parasites. Managing pastures to favor populations of beneficial soil organisms will decrease parasite levels on pastures. Oxygen is the primary requirement for worm eggs and larvae to survive and develop. Earthworms have been shown to ingest worm eggs and larvae, either killing them or carrying them far enough below ground to keep them from maturing. Dung beetles ingest and disperse manure, taking it to their burrows, thus keeping eggs and larvae from developing. There are also nematophagous fungi that produce "traps" that engulf and kill parasitic larvae. These fungi are more delicate than other fungi, so there are rarely great numbers of them in the soil. If the soil is depleted or out of balance, other, more dominant microorganisms will replace these fungi. Research in New Zealand and the Netherlands is in progress using nematophagous fungi to determine if they can be fed to cattle or other ruminants to kill larvae in manure piles and the surrounding soil (5). This research is in its infancy and a marketable product is years away.

The amount of time that feces remain on the pasture has an effect on the number of parasite larvae that survive and mature. Anything that hastens the breakdown of the feces will lessen the number of larvae. This can include the soil organisms mentioned above, mechanical dragging of pastures, poultry or other animal disturbance and the consistency of the feces themselves.

Effect of Ivermectin on Dung Beetles

There is concern today about the effects of ivermectin on soil organisms, especially dung beetles. Research has shown that the use of ivermectin kills dung beetle larvae for up to 45 days through residue in the manure (6, 7). Manure from livestock treated with ivermectin does not break down as fast, either. Other dewormers don't appear to have the same effect. Also, the management system has to be taken into consideration. Ivermectin under some circumstances will be no more detrimental than any other chemical dewormer. Soils with no dung beetles will not be any more adversely affected by the use of ivermectin in livestock than by other dewormers. Farmers using controlled grazing methods and working to improve the health of their soil are the ones who will be most affected by using ivermectin. One way to use ivermectin while working to improve soils is to have a sacrifice area where animals are kept until the majority of the ivermectin is excreted from them. The pour-on formulations of ivermectin affect dung beetle larvae for the least amount of time, the sustained release formulation for the longest period of time (6).

Strategic Deworming

There will be times when chemical dewormers are the best treatment. The situation, time of year and location will help determine which chemical dewormer to use. These dewormings should be strategically carried out in order to reduce the number of times needed. There are three main classes of wormers--the benzimidazoles, such as fenbendazole or Safeguard™ (white); the imidazothiazoles, such as levamisole (yellow); and the avermectins, of which ivermectin (clear) is a member. Rotating these three classes yearly is an accepted rule for decreasing resistance buildup by the parasites themselves. It is critical to reworm three weeks later, especially with newly weaned animals. This kills those worms that were ingested and matured following the initial deworming. This has been shown to significantly reduce pasture

contamination. Strategic deworming is discussed in detail in the enclosure "Alternative Approaches to Managing Small Ruminant Gastrointestinal Nematode Parasites."

It does little good to deworm livestock and return them to the same infected pasture. Do not deworm and immediately move animals to a clean pasture. All the dead worms, with very viable eggs in them, will be passed to contaminate the pasture. Instead, deworm, hold animals in their same location for 12-24 hours, and then move them to a clean pasture. Appropriate management minimizes re-infection. Strategies discussed in the enclosures include calving or lambing on clean pasture, weaning calves and lambs to clean pasture (with cows and ewes grazing the infested pastures in the fall), and pasture rotation between cattle and sheep. There are several ways to utilize multiple animal species to control the worm population. One technique that appears to work well is dividing your farm in half, with cattle on one half and sheep on the other half. Midway through the grazing season, switch halves of the farm. Having one species of livestock follow another one will have a benefit. The different livestock species will break up manure of other species and will not avoid those areas of pastures. This will break the life cycles of the parasites because their natural host will not be present.

There are many claims of different dewormers that they will increase the weight of animals by so many pounds. It is up to the producer to determine if this increased poundage is economically justified. Animals and worms have developed together. Getting rid of all worms all the time is not essential for the health of the animal, is rarely cost effective and can actually be detrimental since the immune system of the animal is an important defense mechanism in managing parasite effects.

Make sure that your dewormer is effective. If you are concerned that it isn't, have a veterinarian check the egg count in the feces of about 15 animals before treatment. After 10

days, check the egg count again. There should be at least an 85 percent kill. You may need to consult your veterinarian about the most effective dewormers for your area. If parasites become resistant to a particular family of dewormers, then you will have to switch families. Alternating families of wormers is a good way of slowing resistance to the dewormer. Many people alternate every time they worm. Research does not recommend this. Instead, use the same dewormer for a whole year before switching. The enclosure "Is Parasite Control Possible?" discusses dewormer resistance.

To implement any type of integrated parasite control program it is essential to know when loads will be highest, such as at lambing; where the young animals stay at those highest egg production times; how pastures can be divided and how long they can be rested in order to let eggs and larvae die. If the producer has some idea of how much parasite infestation exists, this will also help in determining whether, and how often, chemical deworming should be given. Some scientists and producers say that rotationally grazed pastures do not aid in parasite control, because the rest period is usually not long enough to break the life cycles of parasites. This is true. Most pastures are rested between 21-30 days during the growing season, which is also the length of time it takes for infective stage larvae to develop. The goal then is to lower the number of infective larvae that are ingested by the animal. If even one thing can be done to lower these parasite numbers, it will help reduce the need for chemical dewormers. One such technique was demonstrated by Dr. Louis Gasbarre (8). He showed that by deworming adult dairy cattle after they have been rotated through all the farm's paddocks (which took nineteen days), all the larvae that survived the winter on the pastures were eaten by the cattle and then killed by the deworming. This deworming was done before the larvae had matured to egg-producing worms. This eliminated the need for three additional dewormings on that particular farm.

Managing the length of time animals remain on a pasture is also important to remember. This is just one other item that has to be figured in when doing pasture planning for a season. Don't let those pastures be grazed too short!

Alternative Dewormers

Most alternative dewormers have not been shown by scientific research to have any effect on numbers of worms. Diatomaceous earth (DE) has been promoted by some for controlling internal and external parasites in livestock. Almost pure silica, DE is the finely ground fossilized remains of diatoms, tiny sea organisms that accumulate on the sea floor and can be mined from deposits. The diatom remains have microscopic cutting edges that are said to pierce the outer protective layer of parasitic worms and insects, causing dehydration and death. There is little scientific data on the effectiveness of DE for internal parasites, but researchers have seen a decrease in flies on animals when using DE. I have enclosed a report from The Leopold Center about a project that showed no statistical difference between the use of DE and the control group. I have talked to Dan Morrill, Sheep Extension Specialist at Iowa State, who told me that they had a hard time even getting the lambs infested with worms, which was necessary to test to the effectiveness of DE. I bring up this point to make you aware that farmers must know if their animals even have worms in order to know whether control measures are needed, are effective, or how to effectively change them.

Many producers have claimed that they have had good results with DE, but their management is usually very good. They may be giving credit to the DE when they should be giving it to themselves. Although I have nothing to back me up, I've often wondered if it isn't the minerals in the DE that provide the benefit. Worm egg count also naturally falls at the end of summer and the beginning of fall. People who are doing fecal egg counts (FEC) may be thinking the DE is lowering the egg

counts, instead of realizing that it is the natural cycle. I haven't talked to any producer who uses DE without significantly changing and then watching their management. Using DE is not just a simple substitute for a chemical dewormer. This is another problem with the scientific research that has been done on DE. Researchers have simply substituted DE for their conventional wormer and done everything else exactly the same. This is component research, whereas to really prove that DE has an effect, systems research needs to be done, using the same or similar management techniques that producers use. This type of research is much more difficult to do. If you still want to use DE, one dosage that I've seen used is ten to twenty pounds per ton of mineral supplement. Every animal must be fed a dose every day to be effective.

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Deworming alternatives exist in herbal and folk medicine used for centuries in other cultures. Herbs such as garlic work not by killing the worms, but by making the intestinal tract healthier. Since worms and other intestinal parasites have evolved to thrive in the unhealthy digestive tract, anything that will make that environment healthier will be detrimental to their survival. Dr. Susan Wynn (9), writing in the Journal of American Holistic Veterinary Medical Association, discusses alternative dewormers in great detail and points out that much more research needs to be done to determine the effectiveness of herbs and other natural substances traditionally used as dewormers. Her article also states that many herbs can be toxic to animals, so great care should be taken in giving them. There are veterinarians who use herbs as part of a parasite control program. The AHVMA (10) has a list of veterinarians practicing complementary and alternative medicine in every state.

Conditions with Signs Similar to Parasitism

Keep in mind that there are other conditions that can mimic the signs of parasites. It is easy to assume that any unthrifty or thin animal with a rough hair coat or diarrhea is wormy. Internal parasites may be present, but the clinical signs are secondary or a symptom of some other, more insidious disease or condition. Any stressful condition, such as a weather extreme, can cause borderline clinical parasitism to become severe. If animals do not have enough forage or other feed in the fall so that they go into winter in good condition, this lack of condition will cause additional stress on the animal in other ways. This animal will be more apt to show extreme clinical signs of parasitism, including blood loss and death, than an animal which might have some internal parasites but is in good physical condition and is on a high plane of nutrition. In this case, poor nutrition is the cause of the animal's disease and worms are the symptom.

Fescue toxicosis is often blamed when animals are actually wormy. These two conditions can also work together, and it can be hard to determine which one is the main culprit. Fescue toxicosis is especially blamed when bringing animals from the western states. While that indeed may be a problem, the farmer needs to look at the time of year the animals have been placed on fescue, what their overall body condition is, and also check for the presence of worm eggs in the feces.

Conclusion

There is no one thing that can be given or done to replace chemical dewormers. It will take a combination of extremely good management techniques and possibly some alternative therapies. Do not think you can just stop deworming your animals with chemical dewormers. It is something you will need to change gradually, observing and testing animals and soil, in order to monitor your progress. Alternative parasite control is an area that is receiving a lot of interest and attention. Programs and research will continue in the

pursuit of parasite control, using alternative and more management-intensive methods.

References:

- 1) Whitlock, J.H., et al. 1943. The relationship of diet to the development of Haemonchosis in sheep. *Journal of the American Veterinary Medical Association*. January. p. 34-35.
- 2) Stear, M.J., K. Bairden, et al. 1997. How hosts control worms. *Nature*. September 4. p. 27.
- 3) Barrell, G.K., (ed.) 1997. Sustainable control of internal parasites in ruminants. *Animal Industries Workshop*. Lincoln University, Canterbury, New Zealand. June. 280 p.
- 4) Dr. Craig Reinemeyer
Department of Comparative Medicine
2407 River Dr.
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(423) 974-5727
- 5) Waller, P.J. and Margaret Faedo. 1996. The prospects for biological control of the free-living stages of nematode parasites of livestock. *Volume 26, No. 8/9*. p. 915-925.
- 6) Herd, R.P., et al. 1996. Persistence of ivermectin in plasma and feces following treatment of cows with ivermectin sustained-release, pour-on or injectable formulations. *International Journal for Parasitology*. Vol. 26, No. 10. p. 1087-1093.
- 7) Strong, L., et al. 1996. The effect of faecally excreted ivermectin and fenbendazole on the insect colonisation of cattle dung following the oral administration of sustained-release boluses. *Veterinary Parasitology*. Volume 62. p. 253-266.
- 8) McBride, Judy. 1998. An ounce of prevention equals pounds of milk. *Agricultural Research*. January. p.10-11.
- 9) Wynn, Susan G. 1996. Anthelmintic therapy in holistic veterinary practice. *Journal of the American Holistic Veterinary Medical Association*. February-April. p. 15-19.
- 10) American Holistic Veterinary Medical Association (AHVMA)
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Enclosures:

Adams, Mary. 1997. Natural product evaluated for efficiency in deworming sheep. Leopold Letter. Spring. p. 4-5.

Anon. 1996. "Medicine" plants key to worm control. CashMirror. March. p. 6.

Bowen, Joan. 1994. Economics of parasite control; more isn't necessarily better. sheep! December. p. 15.

Griffith, Charles. 1997. Forage. Ag News & Views. November. p. 1.

Hawker, Lisa Stormes. 1995. Is parasite control possible? National Lamb & Wool Grower. July. p. 28-30.

Herring, Chris. 1994. Ask the vet. The Fiberfest Magazine. Summer. p. 27-28.

Kidd, Randy. 1993. Control parasites organically? The New Farm. November-December. p. 7, 11.

Mitchell, Linda. 1996. Clean grazing for parasite control. New Farmer & Grower. November. p. 8-11.

Scarfe, A. David. 1993. Alternative approaches to managing small ruminant gastrointestinal nematode parasites. In: Proceedings of the 1993 American Dairy Goat Association National Convention. Portland, OR. p. 37-44.

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