Controlling Internal Parasites of Sheep
Michigan State University Extension Service
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INTERNAL PARASITES

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Cooperative Extension Service
Michigan State University

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Inserting a drenching syringe into sheep's mouth

IT IS PROBABLE that some sheep in every Michigan flock are infected with at least one kind of internal parasite. Many species of worms live in the stomach or intestine, but five types of roundworms and one type of tapeworm are common and cause the most serious damage. Two other types of roundworms occur in the lungs of sheep, and a single-celled organism causing coccidiosis occurs in the intestine. In some areas, liver flukes are also a problem.

STOMACH AND INTESTINAL WORMS

Common Name	Scientific Name
Common stomach worm	*Haemonchus contortus*
Brown stomach worm	*Ostertagia circumcincta*
Small stomach worm	*Trichostrongylus axei*
Bankrupt worm	*Trichostrongylus colubriformis*
Nodular worm	*Oesophagostomum columbianum*
Common tapeworm	*Moniezia expansa*
Thread-necked worm	*Nematodirus* sp.

LUNG WORMS

Thread lungworm	*Dictyocaulus filaria*
Hair lungworm	*Muellerius minutissimus*

OTHER INTERNAL PARASITES

Coccidia	*Eimeria sp.*
Common liver fluke	*Fasciola hepatica*
Deer fluke	*Fascioloides magna*

LIFE CYCLES

Losses from these internal parasites can be reduced or even eliminated by following a well planned sanitation, management and nutrition program. The control of a parasite requires an understanding of the life cycle so that treatment can be given at the most strategic time.

Stomach and Intestinal Worms

The stomach and intestinal worms have essentially the same type of life cycle. In this life cycle, the adult female worm deposits many eggs each day which pass out of the sheep in the manure. These eggs are microscopic in size, and very small worms develop in the eggs, which hatch on the ground.

The worms develop to an infective stage in approximately 3 days, depending upon temperature. They develop faster in warm weather and slowly in temperatures under 58 degrees. The infective worms, just visible to the naked eye, crawl on the grass and are eaten by the sheep in grazing.

After being eaten, the infective worms move to the wall of the stomach or intestine where they feed on the wall and grow to maturity. The mature worms continue to feed, and the females deposit from several hundred to several thousand eggs each day. The *common stomach worm* and *brown stomach worm* suck blood, but the other worms which are common in Michigan sheep do not. They cause damage by other means.

Hair Lungworms

This worm has a somewhat different life cycle. Adult worms live in small nodules in the lungs. The immature worms inside the eggs hatch in the lungs and pass out in the manure; but before they can develop further, they must penetrate into land snails or slugs. The

immature worms feed on the snail or slug and grow to an infective stage. Sheep become infected while grazing by accidentally eating the snails or slugs containing the worms. Once in the sheep, the small worms migrate to the lungs where they grow to adult worms. Their presence may cause nodules to form in the lung tissue.

Tapeworms

The common tapeworm lives in the small intestine of sheep. It produces many thousands of eggs each day. These eggs are contained in segments which break off and are passed in the manure. The worm eggs are accidentally eaten by small grass mites, which are extremely numerous on pastures. The eggs hatch and develop to an infective stage within the body of the grass mite. The grass mites containing the infective stage are eaten by the sheep while grazing or are acquired from hay and bedding that contains the mites. The infective stage worm is released from the mite in the intestine of the sheep where it grows to maturity.

Coccidia

Coccidia are very small parasites that are called protozoa. These protozoa enter the walls of the intestinal tract. Here they multiply, swelling the cells of the intestinal wall to the point of rupturing. As a result of this damage to the intestine, diarrhea results and blood is lost through hemorrhage. This creates a bloody diarrhea and a dark tarry feces. If feces containing these protozoa are permitted to contaminate the feed or water, or sheep pick them up from grazing or licking contaminated areas, the sheep become infected, and the parasite travels to the intestine where it produces damage. Most all species of livestock may have, or become infected with, coccidia, but each species has its own selected types. Sheep do not become infected with coccidia from other livestock, nor do they transmit this parasite to other livestock.

Liver Flukes

The life cycle of the liver fluke is different from roundworm cycles. A snail is required for the development of several stages, and the infective stage leaves the snail to encyst on submerged vegetation. Sheep become infected when they eat the infective encysted stage while grazing in low, wet areas.

Effect of Weather

The occurrence of internal parasites in a flock follows a regular annual cycle which depends on the weather. In Michigan, most of the infective stages of roundworms which remain on pasture are killed by winter temperatures. Older sheep kept over winter carry the worms responsible for contaminating pastures with eggs the following spring. Egg production increases markedly at this time of year. Twenty-five female common stomach worms can lay 150,000 eggs in one day. They deposit their eggs on the spring pastures, and the small infective worms can become very numerous in May ready for spring lambs to pick up.

The mites which carry the infective stage of the common tapeworm and the slugs or snails which carry the infective stage of the hair lungworms and liver flukes survive the winter and are particularly numerous during spring and early summer. Spring lambs are most likely to become infected with these two worms when put on pasture, especially on wet, lowland pasture.

Ewes at this time are relatively immune to the effects of the worms because of previous infections. They rarely show symptoms unless subjected to some type of stress. For this reason, while the ewes remain relatively healthy, lambs may die as a result of internal parasites. The lambs that are dying may not be thin. They may actually be fat but die due to the effect of severe anemia as a result of heavy stomach worm infection. Heavily parasitized animals may not always show diarrhea.

CONTROL OF PARASITES

Drenching Materials

Powders are the basic forms of most materials currently used for drenching sheep. They are either put into a liquid suspension (to be administered with a dose syringe) or pressed into a pill or bolus (large pill) form. Pills or boluses are purely a convenience. Liquids in general are cheaper, act faster, are easier to administer and less risky to use. They may be somewhat more messy in the hands of the inexperienced.

Liquid suspensions are by far the preferred form, and the following discussion therefore will pertain to liquid preparations.

Phenothiazine is still one of the most commonly used drenching materials. Only the fine-particle material should be used. There is no evidence that stomach worms are resistant to the fine particle preparations. These, however, are not effective against all species of round worms or against tapeworms, lungworms, liver flukes and coccidia. It is the material commonly recommended to include with trace mineral salt as a low-level treatment.

White-faced sheep exposed to bright, intense sun immediately following drenching with phenothiazine

may develop sensitivity to light. The head puffs up, and severe skin conditions may result. Provide shade for sheep, at least for 3 to 4 days after drenching. Persons administering the drench may also experience severe sunburn if the phenothiazine comes in contact with the skin. This is especially true of fair-skinned individuals. Phenothiazine may also produce sedation or a tranquilizing effect on the sheep, but this will disappear in a few hours.

Lead arsenate is effective against tapeworms, but should be used only in combination with fine-particle phenothiazine as a commercial drench. Do not attempt to use lead arsenate alone, and do not attempt to mix it at home with phenothiazine. Use only the commercially prepared drenches. Do not include lead arsenate in the phenothiazine-salt mixture.

Thibenzole (Thiabendazole) is effective against certain species of round worms (brown stomach worms and bankrupt worms) for which phenothiazine is only moderately effective. It can be safely used in treating pregnant ewes, young lambs, and sheep and lambs in a weakened condition. It is also effective against the larval or immature stages of some parasites. It does not discolor wool. It is not effective against tapeworms, lung worms, liver flukes and coccidia. It is not available in combination with lead arsenate and it should not be mixed with salt as a low level treatment. It is a white powder easily mixed with water. Only the approximate amount to be used should be mixed at one time, since once mixed with water, it does not store well. It is available in a prepared suspension and can be stored satisfactorily. It is also available in the bolus form.

Loxon (Haloxon) is an organo-phosphate material. It can be safely used in treating pregnant ewes, young lambs, and sheep and lambs in a weakened condition. It does not discolor wool. Like Thibenzole, it is effective against the common stomach worm, bankrupt worm and black scour worm. It is only slightly effective against the nodular worm, and not effective against tapeworms, lung worms, liver flukes and coccidia. It is not available in combination with lead arsenate and should not be mixed with salt as a low level treatment. It is an almost tasteless, odorless, white powder and mixes easily with water. Unused mixed suspensions may be kept.

Tramisol (Tetramizole) is a highly effective drench against most species of stomach and intestinal worms except tapeworms. It is also reported to be effective against both the hair and thread lung worms. It is not effective against liver flukes and coccidia. It can be used with safety in treating pregnant ewes, young lambs, and sheep and lambs in a weakened condition. It does not discolor wool. It is a white powder which dissolves readily into an orange-colored liquid. It is also available in the bolus form. It is not available in combination with lead arsenate and should not be mixed with salt as a low level treatment.

From the brief discussion of each of the above materials, it can be noted that not one of the drenches mentioned is effective against all internal parasites of sheep. Further, in order to forestall the possible development of immunity by the parasite from the continuous use of only one of these drenches, it is recommended that materials be alternated. Use a specific drench at the time of year when the parasite for which it is most effective is likely to be the most serious. For example, common tapeworms are likely to be most serious in June and July. Therefore, this would be the time of year to use the phenothiazine-lead combination, as this material is especially effective against this parasite. *Caution:* Read the label provided with the material used. Follow instructions carefully. Note and follow instructions regarding the number of days the material can be used before slaughter of the animal.

Salt Mixture — Ten pounds of phenathiazine to 100 pounds of trace mineral salt — This mixture will be effective only if kept before the flock continuously during the grazing season. It is not recommended to start the phenothiazine program until a flock has finished lambing. Once a flock is accustomed to phenothiazine, many owners keep it before the sheep all year. This is an excellent practice.

Sheep on pasture must not be allowed to be without the mixture for even a single day. Protection against parasites will be greatly reduced if sheep do not have constant access to the phenothiazine-salt mixture.

The phenothiazine-salt mixture should be placed in a container well protected from the weather and readily accessible to the flock. Plans for a covered salt box are available in Plan No. 772-C 1-21 from the Agricultural Engineering and Animal Husbandry Departments at Michigan State University. See Figure 1.

Drenching Equipment and Procedure

There is very little special equipment required for proper drenching of sheep. It need not be elaborate nor expensive.

One of the older methods of drenching sheep involved the use of some form of drench bottle, often fitted with a rubber tube, to give added length and to minimize injury to the sheep. This method is time consuming, obsolete, and dangerous and should be discouraged. Too many sheep ended up with foreign body pneumonia, and quite often much of the drench material was spit out and thus wasted.

Figure 1. — Covered salt box provides continuous low-level feeding of phenothiazine in trace-mineralized salt — a basic step in internal parasite control.

Syringe

Perhaps the most commonly used device is a 2- or 4-ounce dose syringe as shown in Figure 2. The three-ring variety, short barrel, with a 6-inch metal nozzle is preferred. A syringe of this type can now be obtained which makes use of a rubber "O" ring instead of leathers. Other types are available but are less easy to handle, refill and maneuver. Shorter nozzles are messy, wasteful and less effective in proper drenching procedure. Be sure that the tip of the drench nozzle is rounded, smooth and free of injurious, sharp edges.

Automatic Devices

There are numerous automatic drench guns and devices on the market. These devices have a reservoir—usually a rubber or plastic bag—which is strapped to a man's chest or back. A tube leads to the drench gun, which can be adjusted for prescribed dosage. Various types of nozzles, tips and medication devices are available. They are convenient, fast and accurate if used properly, *thoroughly cleaned* after each use and properly stored and cared for so as to prolong their usable life. They are expensive, but save labor when dealing with large numbers of animals.

Proper Care Important

No piece of equipment, regardless of price, is any better than the hands it is in and the care the equipment is given. Many of the products used in parasite control medication are corrosive and injurious to rubber, leather and other materials. It therefore, is vital to the action and life of any piece of equipment that it be completely cleaned immediately following usage. The leathers on dose syringes should be dipped in mineral oil after the cleaning process. This is not necessary with the newer type syringes which make use of the rubber "O" ring.

Before starting a drenching operation, check the equipment for accuracy of delivery. Proper medication depends upon the use of the appropriate drug in an accurate, prescribed amount that enters the animal and reaches the desired destination in its entire dosage. Be sure to administer the proper dosage of the particular medicament being used. Be sure the equipment is set and functioning to deliver this exact amount. One gallon of medication equals 128 ounces. Therefore, if using a 1-ounce dose, a gallon will treat 128 animals. At a 2-ounce dosage a gallon will treat 64 animals. A pint contains 16 ounces, and this is a convenient volume to test the accuracy of the equipment.

To function freely the drenching equipment must be properly cleaned and stored and lubricated as per manufacturer's instructions. Equipment that is sticky and not free in its action is time consuming and not accurate in delivery.

Small Flocks

In small flocks (less than 25 to 40 ewes), the simplest and most commonly used method is to pen the animals up *closely* by means of gates or hurdles. Move among the sheep, drenching each individual and marking them as they are drenched. Regular blue carpenter's chalk or similar marking devices are satisfactory. The sheep should be penned closely enough to limit movement, but not so tightly that individuals may smother or so that the operator can not move around in the pen.

It is hazardous to pen ewes and lambs together because lambs may get trampled and smother in the pen.

The main disadvantages to drenching sheep in a pen are that it is time consuming, and any medicament such as phenothiazine that is on the mouth or face of the drenched individual may be wiped off on the fleece of other animals, thus causing undesirable staining when using certain drenching materials. This is objectionable.

Large Flocks

For larger flocks, it is advisable to have a running chute, either permanently or temporarily constructed for the occasion, using steel posts and wooden gates.

Starting at the holding pen, there should be a funnel-shaped device directing the sheep into the running chute just wide enough to accommodate one individual and narrow enough so the sheep cannot turn around. The operator then stands in the end of the chute catching each sheep between his legs (see picture on page 1) and drenching them as they come through. The operator's legs function as a stanchion. A jug or other container of drenching material should be placed be-

Figure 2. — Proper procedure for discharging drench from syringe.

side the operator, but in a location and position where the medicament will not be tipped over.

Be sure to mix the drench material periodically to keep it from settling out in the bottom of the jug. With a proper set-up and equipment, the operator can refill his syringe with one hand while grasping the muzzle of the sheep, caught between his legs, with the opposite hand. Drench the sheep and release it. Be ready for the next one behind to move forward or be shoved forward by a man standing alongside the running chute.

How to Drench

In drenching, first of all hold the sheep's head in a *level position. Do not jerk the head upward!* Sheep cannot swallow safely with their heads jerked up.

With fingers under the muzzle and thumb over the nose, lift the upper lip by means of thumb (see Figure 3), gently insert the dose syringe nozzle, slide it back over the top or beside the tongue inside the row of teeth. If properly done, no resistance is met and there is no injury nor discomfort to the animal. The thumb has the nostrils depressed.

Depress the plunger on the dose syringe, thus depositing the entire dosage at once in the back of the pharynx.

Release your hold on the sheep's head, the sheep will swallow and can be released.

Prepare to catch the next head coming between the legs. This entire procedure requires 2 to 4 seconds. It is readily possible to properly drench more than 300 sheep per hour with proper equipment, properly set up with two men besides the operator to keep the sheep worked forward and fed between the legs of the operator.

If the sheep spit out or slobber a portion of the medication after drenching, the dose syringe is not being placed back far enough or too short a nozzle is being used. If they cough and gag, a product that is an irritant to the mucous membranes is being used, the syringe is being pushed back too far, or the operator has been rough and injured the back of the mouth and pharyngeal region. It is actually possible to puncture through the wall of the pharynx and deposit the medication there rather than permitting the sheep to swallow it. This leads to abscess formation. Pulling the head too high often results in the medication's entering the lungs, and death of the animal within a few days is the usual result. This need not occur if proper equipment and technique are used.

Withholding Feed Before Drenching

Most materials currently recommended do not require withholding feed before drenching. Be sure, however, to read the label and follow the directions carefully. Drench sheep in the early morning while it is cool. Separate ewes from lambs to avoid injury to the lambs and to make it easier to give proper dosage.

Important Points In Control

1. Know the parasite problem to be treated.
2. Use the appropriate medication indicated by the type of parasite involved—be sure it is thoroughly mixed and not permitted to settle out.
3. Use a properly functioning, accurate dosage delivery syringe.
4. Use a proper setup for confining and handling the sheep.
5. Sort ewes and lambs to aid in handling and minimize possibility of losses.
6. Hold the animal properly and administer the medication.
7. Clean up the equipment immediately and prepare it for proper storage.
8. Put the sheep on clean pasture and practice other good nutrition steps.

RECOMMENDED YEARLY PROGRAM

Frequency of drenching will depend upon the condition of the sheep, management practices, nutrition status, type of parasite involved, and product being

used to cope with these parasites. No set schedule can meet the needs of each and every flock. Each flock must be considered separately and handled according to existing conditions. General recommendations can be made, but specific flock recommendations and practices can best be arrived at by a close working relationship between an interested, well informed, and conscientious shepherd and veterinarian.

If operators find it necessary to repeat drenching at 21- to 30-day intervals, there is probably something wrong in management, nutrition, prophylactic measures, or choice of drug being used.

Recommendations and Suggestions

Spring – Drench adult sheep 3 to 4 days before they are turned to pasture. The purpose of this drench is to reduce the mature parasite load as much as possible in the sheep and thereby reduce the contamination of the summer pasture with parasite eggs. If the ewes have finished lambing, any of the compounds listed under "Drenching Materials" may be used. If the ewes have not finished lambing, use Thibenzole, Loxon, or Tramisol.

If lambs have been "pasturing" around the barnyard or building, there is a strong possibility that they have become infected with one or more species of internal parasites. Therefore any of these lambs past two weeks of age should also be drenched. Early lambs that have been kept strictly in a dry lot (no opportunity to eat *any* grass) and are to be marketed directly from the dry lot, generally need not be drenched. Tapeworms may infect lambs kept in the dry lot. To reduce this parasite, use phenothiazine-lead arsenate drench. Follow directions carefully.

Keep phenothiazine and salt mixtures before the flock at all times mixed at the rate of one pound of phenothiazine to ten pounds of trace mineralized salt. No other source of salt should be available to the sheep.

Summer – Drench all sheep and lambs with fine-particle phenothiazine-lead arsenate drench between June 1 and July 1. This is the important time to control tapeworms and roundworms. Continue phenothiazine and salt mixture.

Late Summer-Early Fall – Drench lambs at weaning time and turn on clean pasture. Use Loxon, Tramisol or Thibenzole. Continue phenothiazine and salt mixture for both ewes and lambs.

Fall – Drench breeding ewes and rams with Thibenzole, fine particle phenothiazine, Loxon or Tramisol one week before ram is turned with the ewes. Continue phenothiazine and salt mixture.

Winter – Drench ewe and ram lambs that are being saved for breeding stock when they are brought in from pasture. Use Loxon, Tramisol or Thibenzole, but preferrably not the same material used in late summer or early fall. It is a good practice to continue feeding the phenothiazine salt mixture during the winter. It eliminates the problem of getting the flock accustomed to the mixture again and aids in keeping the number of fertile worm eggs passed in the manure at a low level.

Liver Flukes

Sheep grazing in areas of Northern Michigan where deer are common may become infected with the deer liver fluke. This large, leaf-shaped parasite can cause serious damage to adult sheep and will frequently kill lambs. Positive diagnosis of this disease in sheep can be made only by finding the flukes in the liver when animals are autopsied. Parasite eggs are not passed in the manure of the sheep since the sheep is an abnormal host. The infected deer as the natural host does pass eggs of the parasite, and in this way contaminates pastures.

Control of liver flukes is very difficult. Diagnosis is difficult and expensive. Treatments are toxic and should be undertaken only after a careful appraisal and evaluation of the flock situation by qualified personnel. Exclusion of deer and snails from low, wet areas is not practical.

Lungworms

Tramisol is currently the most effective material to use in removing thread and hair lungworms. The continued use of the low-level phenothiazine and salt mixture may gradually reduce, if not eliminate, these two parasites from an infected flock.

Coccidia

Treatment with sulfonamide drugs (Sulfadiazine, Sulfaguanidine) may have good results if given soon after the trouble appears. The recommended dosage is one gram per 15 pounds of body weight for 4 days. (It cannot be assumed that drugs used for coccidiosis in chickens can be given to lambs. Some of these are very toxic to sheep.) Drugs like nitrofurazine can be given in the water for 7 days at 0.01% and can be very effective in treatment. Some feedlot owners use low levels of sulfaguanidine or amprolium in the water as a preventive measure. Lambs which recover from the infection are immune, but if the infection was severe they may be permanently stunted. Preventing the disease by providing dry, clean and uncrowded quarters with well-designed feed and water troughs is by far the most economical measure.

Drenching Lambs Not Turned to Pasture

A well managed dry lot for feeder lambs is not as favorable for the transmission of most parasites as is

pasture. The lambs usually will not feed from the ground since food is provided in bunks and racks. The bedding and ground should be kept dry. Soiled bedding should be removed to prevent a buildup of infective stages. However, hay or bedding supplied to the lambs may be contaminated with infective stages of parasites, particularly the grass mites which may transmit tapeworm larvae. The grass mites can travel some distance from adjacent pastures into the barn or feed lot, and under certain conditions the mites may establish themselves in the barn. Therefore, it would be highly desirable to drench early lambs with the phenothiazine-lead arsenate drench. Follow directions carefully.

Drenching Feeder Lambs

Native feeder lambs are usually infected with several species of internal parasites. They should be drenched as soon as possible after arrival at the farm or feed lot. Use Thibenzole, Loxon or Tramisol at this time. However, since these materials are not effective against tapeworms, the phenothiazine-lead arsenate drench should be used about two weeks later if segments of tapeworms are noticed in the droppings.

Feeder lambs shipped into Michigan directly from Western ranges are generally relatively free from internal parasites, but since the source of previous treatment is not always known, drench as suggested above within a few days after arrival. Phenothiazine may also be used.

If either native or Western feeder lambs are to be turned to pasture, the phenothiazine and salt mixture should be available to the flock at all times.

Pasture Rotation

Rotation of sheep from pasture to pasture is frequently recommended, but the exact requirements for control of parasites by pasture rotation are seldom described. Indeed, certain pasture rotation practices can increase parasitism in sheep.

The theory behind pasture rotation for control of roundworms is to (1) move sheep from the pasture they are contaminating before the parasite stages become infective, (2) move to a pasture with few or no infective stages, and (3) do not return sheep to previously used pastures until the climatic factors have reduced the number of infective stages to a very low level.

It is apparent that considerable pasture is necessary for rotation, especially if climatic conditions are not severe enough to kill infective larvae in a few weeks. Under most Michigan conditions, sheep would have to be rotated each week and not returned to the used pasture until the next summer. This makes the control of internal parasites of sheep by pasture rotation alone virtually impossible.

SUMMARY

A well-rounded parasite control program is not happenstance. It requires a basic knowledge of sheep — their habits, management, nutrition and related factors. It also requires a basic knowledge of parasites — their life cycle, the problems they create and what drug or medication can be used to control or remove them. It should, therefore, be evident that a well-rounded parasite control program requires concerted effort on the part of the shepherd and his veterinarian to combine their basic store of knowledge and apply this information intelligently in developing a program for the specific flock.

Remember that sheep in extremely poor, rundown condition are poor prospects for treatment. Any product potent enough to kill parasites will also have some adverse effect on the host. Therefore, use caution in the selection of products and administer them according to prescribed dosage. Practice parasite control measures at the proper time—BEFORE the general health of the flock deteriorates severely and deaths occur.

Certainly, the old adage — "An ounce of prevention is worth many pounds of cure" — pertains to sheep parasite control.

If the measures prescribed in this bulletin are followed by Michigan shepherds, the health of Michigan sheep flocks should be markedly improved.

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