

JULY, 1949

BULLETIN 527

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

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Internal Parasites Of Sheep

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THIS BULLETIN AT A GLANCE

Internal parasites of sheep most common in Missouri are the large and small stomach worms, the nodular worm and two kinds of tapeworms.

When these pests are held to a minimum by well established control methods, less common internal parasites are not likely to cause serious loss.

Worm infestations in sheep may be detected by paleness of membranes lining nose and mouth, unthrifty appearance, diarrhea and loss of weight.

To control these pests it is necessary to kill the worms or expel them from the digestive tract of the sheep before eggs are laid for a new and larger infestation.

A popular and effective treatment for stomach worms is drenching with a copper sulphate solution. The sheep should be fasted 18 to 24 hours before treatment and dosed according to weight.

Such treatment should be started in the spring and repeated every 3 or 4 weeks summer and fall. Sheep weakened by heavy infestation require smaller dosage at shorter intervals.

An unsafe practice is the addition of copper sulphate to salt kept in the sheep pens. Many cases of poisoning have followed this practice.

Phenothiazine, a relatively new drug, is effective for stomach worms and nodular worms either as a drench or mixed with salt. It is especially valuable for controlling nodular worms, which did not yield to the older treatments.

For sheep infested with internal parasites, individual dosing before they are turned in on the phenothiazine-salt mixture is recommended.

Phenothiazine mixed with salt is more expensive than copper sulphate, but its use requires less labor than drenching the animals individually with the cheaper copper sulphate solution.

If any approved treatment for internal parasites is to succeed it must be supplemented by liberal feeding and year-round watchfulness to detect the first signs of infestation.

Internal Parasites Of Sheep

CECIL ELDER AND DONALD E. RODABAUGH

The parasite problem in Missouri sheep raising is gradually becoming more serious. Losses from internal parasites are heavier than from any other disease affecting farm flocks, and unless control measures are used these losses will continue to increase. Enough information has been gathered on this problem and about control methods that it is now easily possible to cope with this situation. That is, if certain fundamental principles are adopted and followed.

Although several species of parasites are found in Missouri sheep, the most serious seem to be the stomach worm (*Haemonchus contortus*), the nodular worm (*Oesophagostomum columbianum*), the tape worm (*Moniezia expansa* and *Moniezia benedeni*), and the small stomach worm (*Ostertagia circumcincta*). The numbers of small stomach worms are probably not great, but they have been observed in many cases during the past ten years. It is believed that if the foregoing parasites are held to a minimum, the loss from other parasites less frequently encountered would not be of economic importance. Other sheep parasites observed in Missouri are *Nematodirus filicollis*, *Trichostrongylus* spp., *Strongyloides* spp., *Trichuris ovis*, and *Cooperia curticei*. In some sheep very large numbers of *Nematodirus* have been found.

The general symptoms of parasitism (and this applies in a large measure to infestations with one or more species) may be very marked, especially when the infestations are heavy. Young animals, especially lambs, are more subject to the ravages of parasite infestation and the damage is more extensive than in older sheep. The symptoms generally noticed are loss of flesh, unthrifty appearance, diarrhea, and pale mucous membranes. As the disease advances and the infestation becomes heavier there is marked loss of weight, weakness, and in many cases death. Investigations at the Missouri Experiment Station show that the heaviest death losses from stomach worms and nodular worms occur in late summer and early fall but on some farms death losses have occurred in other seasons, too.

Each of the parasites affecting domestic animals has a very definite life cycle, though all details of all these life cycles are not yet known.

STOMACH WORMS AND NODULAR WORMS

There is much difference in the life cycles of various internal parasites, some of them being more complex than others. In general, the stomach worms and nodular worms have a rather simple life cycle. The adult female worms located in the digestive tract of the sheep produce large numbers of eggs, which are eliminated with the droppings. These eggs hatch out on the ground in a few days or a few weeks, depending upon the weather. Development is much more rapid in warm weather than in cooler or cold weather. The small larval form of the parasite, after emerging from the egg, undergoes further development in the ground. When these larvae reach the so-called infective stage they crawl up on the grass when it is wet with dew or rain. Grazing sheep swallow the parasites, and these remain in the stomach or intestinal tract, where they undergo further development.

The stomach worm remains in the fourth stomach of the sheep and grows to maturity, mates, and is ready to lay eggs, thus completing the life cycle.

The nodular worm larvae enter the wall of the intestine where they remain for varying lengths of time. A small nodule develops

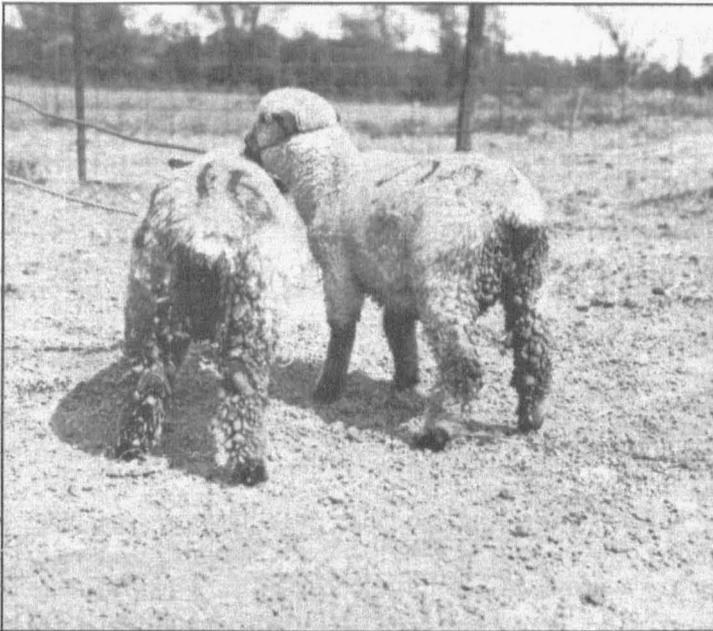


Fig. 1.—Experimental lambs heavily infested with internal parasites. Note soiled wool, due to diarrhea.

around the area in which this larval form is located and it is from this tissue formation that the nodular worm gets its name. After a certain amount of development the worms return to the lumen of the digestive tract, make their way to the large intestine, grow to maturity, and start laying eggs, thus completing their life cycle. Nodular worms probably produce the most serious damage of any of the internal parasites in Missouri.

TAPEWORMS

The tapeworms are somewhat different, as part of their existence is spent in another species which is known as the intermediate host. The eggs of the tapeworm are passed in the droppings while they are still within the mature segments. These segments are flat and readily visible to the naked eye. The eggs after finding their way into the intermediate host undergo development and remain there until they can get into the final host's body, where they grow to maturity and again start their life cycle. The intermediate hosts of several of the tapeworms are as yet unknown.

The control of parasites is based upon an attempt to break the life cycle, therefore efforts should be made to apply control measures at the most vulnerable spot. The post mortem examination of sheep must be made within one hour after death to get the most dependable results in parasite studies or diagnosis.

TREATMENTS AGAINST PARASITES ARE EFFECTIVE

Copper Sulphate Solution.—One treatment for stomach worm infestation is to drench with bluestone or copper sulphate made up in solution. For many years it has been known that 1% copper sulphate solution is a very satisfactory and efficient treatment if properly administered. The copper sulphate solution is made up by dissolving 4 ounces of bluestone or copper sulphate crystals in 1 pint of boiling water. Care should be taken that only blue crystals are used; the white crystals should be discarded from the medicine. When the crystals have been thoroughly dissolved in the hot water sufficient cold water should be added to make a total of three gallons of solution. This amount of bluestone solution is enough to dose about 96 adult sheep. The medicine may be given with a dose syringe, a funnel and hose, a drenching bottle, or stomach tube.

In preparing the solution it is preferable to use distilled water, rain water, or water that has been boiled. Since the bluestone is corrosive, this solution should be prepared in earthenware, porcelain, or glass containers. It is absolutely essential that the crystals be completely dissolved and the medicine thoroughly mixed before it is administered to the sheep.

The amount of medicine to give each sheep may be determined on an age or weight basis. Workers at this experiment station think the weight basis is more satisfactory because it insures a more correct dosage. The dosage table recommended is:

- 1 ounce for sheep weighing 20 lbs.
- 2 ounces for sheep weighing 40 lbs.
- 3 ounces for sheep weighing 60 lbs.
- 4 ounces for sheep weighing 80 lbs. or over.

The flock (except nursing lambs) should be fasted for 18 to 24 hours before dosing. They are allowed to have water during that time. After the medicine is administered both feed and water should be withheld for a 3 to 4 hour period. Lambs should be separated from the ewes before they are treated. Lambs should not be allowed to nurse for 2 or 3 hours after the bluestone has been administered, as the milk not only dilutes the bluestone but interferes with its action in the stomach. The lambs may be permitted to stay with their mothers during the fasting period but should be separated just before the medicine is given.

In order to get the best results this treatment should be started early in the spring and continued through summer and fall until about December 1, under average Missouri conditions. The interval between treatments should be 21 to 28 days. When a flock is heavily infested with stomach worms it may be necessary to treat every 7 to 14 days until the flock begins to improve, after which the interval between treatments may be extended to the usual 21 or 28 days. Sick or very weak sheep should not receive a full dose. It is recommended that they get a half dose and have this repeated in about 7 days. As soon as they begin to improve the interval may be increased and the full dosage may be given without danger.

It should be kept in mind that proper precautions in dosing the sheep should always be taken and that the medicine be given slowly and carefully to avoid strangling the animal by getting the solution into the lungs. When flocks were treated in this manner, and reasonable precautions taken to protect the young lambs from exposure, very satisfactory results have been obtained in the control of stomach worm infestations.

Since there has been some thought that the 1% copper sulphate solution was not doing a good job, extensive experiments were undertaken in the veterinary department of the Missouri Experiment Station a few years ago. Since then considerable work has been done with a 1½% solution of copper sulphate. This is made up by using

6 ounces of copper sulphate crystals instead of 4. Close observation of sheep receiving $1\frac{1}{2}\%$ copper sulphate solution on the same dosage table as previously outlined indicated that this was a safe procedure and that the sheep suffered no apparent ill effects from the increased amount of copper sulphate in the solution. Care should be taken to measure dosages accurately, because too much copper sulphate is poisonous to sheep and has caused death in several instances where the dosage was too great.

The work at this station also indicated that the 1% copper sulphate solution, properly used and administered through the greater part of the year, will give good and satisfactory results. If results have not been satisfactory it will be safe to give up to $1\frac{1}{2}\%$ solution in the same dosages. Copper sulphate must be given as a drench and the sheep treated individually.

The addition of copper sulphate to the salt to control stomach worms is unsafe. Many cases of copper sulphate poisoning have occurred following the use of this practice. The main reason for this is that the sheep needing the treatment most fail to get the required amount, while sheep needing the treatment less are likely to be overdosed.

Other Treatments.—Other treatments, including tetrachlorethylene and phenothiazine, have been found satisfactory for the removal of stomach worms, but the copper sulphate treatment, though a more laborious method continues to be popular because of the low cost of the medicine.

Phenothiazine has been found to be very efficient in the removal of stomach worms and may be given to the sheep without fasting the animals. In fact, it appears to be more effective when the sheep are not fasted. This very distinct advantage is more or less offset by the higher cost of the phenothiazine at the present writing. Phenothiazine is a comparatively new drug on the market but its efficiency as a vermifuge has been proved and must be recognized.

The treatment for tapeworms is recommended only when their presence in a flock has been definitely established. Nicotine sulphate added to the copper sulphate solution will be found quite effective as a drench for tapeworm removal. Nicotine sulphate is generally used in the form of Blackleaf 40, and 1 ounce of nicotine sulphate (40%) is added to each gallon of copper sulphate solution. The dosage is the same as indicated for stomach worms.

SMALL STOMACH WORMS

Copper sulphate has not been very satisfactory for the removal of small stomach worms, but copper sulphate in combination with

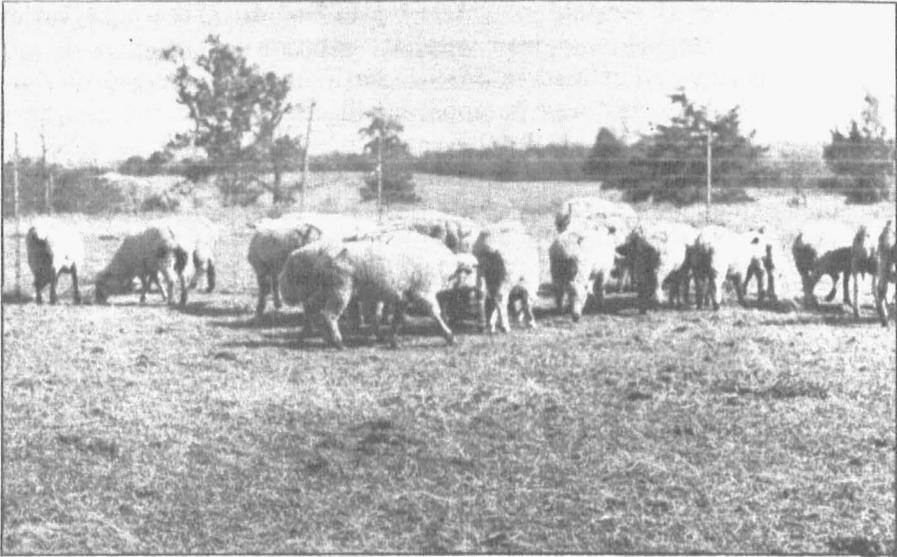


Fig. 2.—Farm flock heavily infested with stomach worms and nodular worms.

nicotine sulphate has given fairly good results. Fortunately, at present in Missouri flocks, small stomach worms are not nearly so numerous as the common stomach worms. If they are known to be present in a sheep flock the combination of copper sulphate and nicotine solution is recommended. Since this small parasite is becoming more common in sheep, it probably could account for losses where the treatment used should have caused the flock to straighten up but failed to produce satisfactory results. A special autopsy technique is necessary to demonstrate the presence of *ostertagia*.

NODULAR WORMS YIELD TO NEW TREATMENT

Until recently there was no satisfactory treatment for nodular worm infestation, but phenothiazine has been found effective against this parasite. It has been very efficient in removing the adult nodular worm and stomach worms. It is not effective against tapeworms of sheep, nor in our experiments has it given satisfactory removal of small stomach worms.

The efficiency of phenothiazine for nodular worm control has been a great boon to the sheep raising industry, since these parasites are very common in Missouri. It is rare indeed to find a flock of sheep that does not have some nodular worm infestation.

Phenothiazine may be given in the powder form in gelatin capsules, or may be given in a liquid form in which the drug is held in suspension. The correct dosage is given on the container. For the

liquid form, the usual dosage is 1 ounce for lambs and 2 ounces for mature sheep. Experimental sheep have received phenothiazine every 28 days without any danger, but the cost of such treatment may be considered by some persons as prohibitive.

Following any treatment, if the sheep could be kept for 24 to 48 hours in a small lot, the amount of parasite egg contamination of pastures would be greatly lessened, because large numbers of parasites and parasitic ova are passed out with the droppings during this period. It would then be highly advisable to remove such material and spread it on fields that are to be cropped. Although not usually followed, this practice is very helpful where infestations are extremely heavy.

PHENOTHIAZINE IN THE SALT IS RECOMMENDED

On many farms the feeding of phenothiazine in the salt will supplant the other methods for controlling internal parasites and in most cases will be found entirely satisfactory. An easy and practical way to administer the phenothiazine to sheep is to mix it with the salt and let the animals have free access to it. Different amounts of phenothiazine have been recommended, varying from 1 part phenothiazine and 9 parts salt to 1 part phenothiazine and 14 parts salt. Work at the Missouri Experiment Station has shown that 1 part of phenothiazine and 10 parts of salt is a very satisfactory combination.

When animals are heavily parasitized it is best to remove the parasites by drenching before putting the sheep on the phenothiazine-salt mixture. If sheep are reasonably free of parasites when they are put on this mixture, it will be found very efficient in controlling internal parasites, especially nodular worms, and stomach worms.

The phenothiazine-salt mixture is fed free choice and should be put out in quantities sufficient to last about two weeks. This amount can be determined by weighing a known amount of salt and estimating what part of this quantity the sheep consume in a two weeks period. It has been our observation that sheep will consume about the same quantity of phenothiazine-salt mixture as they will of ordinary salt. This phenothiazine-salt mixture should be put in troughs or boxes which are protected from the weather and rain and a fresh supply should be given every two weeks.

When sheep are kept on the phenothiazine-salt mixture through spring, summer, and fall and properly fed at the same time, the worm population will be held to a minimum. We have found it practical to keep the sheep on such a mixture the entire year. When this was done there was no indication that phenothiazine had any detrimental effects on breeding efficiency or at lambing time.

If the phenothiazine-salt mixture is not started in the spring and the flock becomes heavily parasitized during the summer or early fall, it is recommended that the flock be treated with individual doses of phenothiazine or copper-sulphate or both.

If tape worms are known to be present nicotine-sulphate may be added to the copper-sulphate. The copper-sulphate may follow the phenothiazine in individual doses after a period of five or six days or the phenothiazine may be given five or six days following the copper-sulphate. After one or both of these treatments, the sheep may be placed on the phenothiazine-salt mixture and kept on it for the rest of the season. It is essential that the parasites are removed before the sheep are placed on the salt mixture.

The phenothiazine is highly effective in the removal of nodular worms and we have found if phenothiazine is fed continuously in the salt for two or three years that a farm can be practically freed of this parasite. The continuous feeding of phenothiazine in the salt is more expensive than individual doses of copper-sulphate every 28 days. But many live-stock operators feel the feeding of phenothiazine in the salt is more economical, especially when one considers the cost of labor, the losses associated with the extra handling of the sheep, and the increased gains made.

YEAR-ROUND CONTROL IS ECONOMICAL

It was found at the Missouri Experiment Station that when sheep consumed more phenothiazine in the salt that they made better gains and had fewer parasites. In our 1947 experiments three different lots of sheep consumed between May 1 to November 15, an average of 0.43, 0.49, and 0.69 grams of phenothiazine per head daily. This made the phenothiazine consumption that year approximately $\frac{1}{2}$ ounce per head per month. This method of controlling parasites seems to be very practical under average Missouri conditions. The value of proper nutrition along with this or any other treatment should not be under-estimated.

PROPER FEEDING IS ESSENTIAL

Experiments at this station have definitely proved that liberal and properly balanced feeding is essential in the control of parasitic infestations. Where the nutrition has not been adequate, the losses from parasites have been correspondingly greater.

The importance of good pastures must be emphasized. The sheep should be rotated on pasture two or three times a year to get the best results. If only one pasture is available and it must be used continuously, then great care should be taken neither to overload the pasture

nor graze it too closely. Proper methods in handling the pasture should be adopted so as to insure adequate feed at all times.

Experiments tend to show that proper feeding is almost as important in the control of parasites as the treatment itself. This does not mean, however, that well fed sheep should not receive parasite treatment when needed. Adequate feeding helps the sheep to ward off parasites and makes the treatments more effective. It also puts them in condition to better withstand the damaging effect of the parasites within the sheep's body.