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Common Parasites of Farm Animals

Their Prevention and Treatment

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Success in stock raising depends to a considerable extent upon the ability of the owner to keep his animals free from parasites of various kinds, since parasitism robs the animal of vitality and the ability to utilize its feed to the best advantage. Stable and feedlot sanitation should be applied frequently and thoroughly. It is far better to prevent the animals from becoming infested than to administer medicines to rid the animals of the parasites after infestation. Consultation, moreover, with the local veterinary practitioner from time to time concerning the care of the herds will prove profitable in keeping the farm stock in a better state of health; and this is particularly true with respect to parasitism.

The practice of resorting to a liberal use of stock remedies of unknown composition, and particularly the proprietary worm remedies, has led to disaster in many cases. And perhaps in the vast majority of cases this practice has not yielded results of any value, or at least not commensurate with the cost of the products purchased.

The purpose of this circular is to supply the stockman who has not the benefit of the advice of a local graduate veterinarian, with information con-

cerning measures of prevention and treatment, which if used with judgment will prove safe and serviceable. Good judgment, however, is essential, since some of the drugs mentioned herein may prove harmful if not used with proper care. Keeping medicines constantly before farm stock is a bad practice. They should receive medicine only when medicines are needed. And in the absence of a competent veterinarian to make a definite diagnosis, careful observation and the best of judgment are required in the giving of treatments. Strict adherence to a rule or formula is not always safe, nor successful, for conditions vary. Common salt, or the simple mixture of salt and wood ashes, is the only appetizer or tonic that is needed to be kept constantly before farm stock.

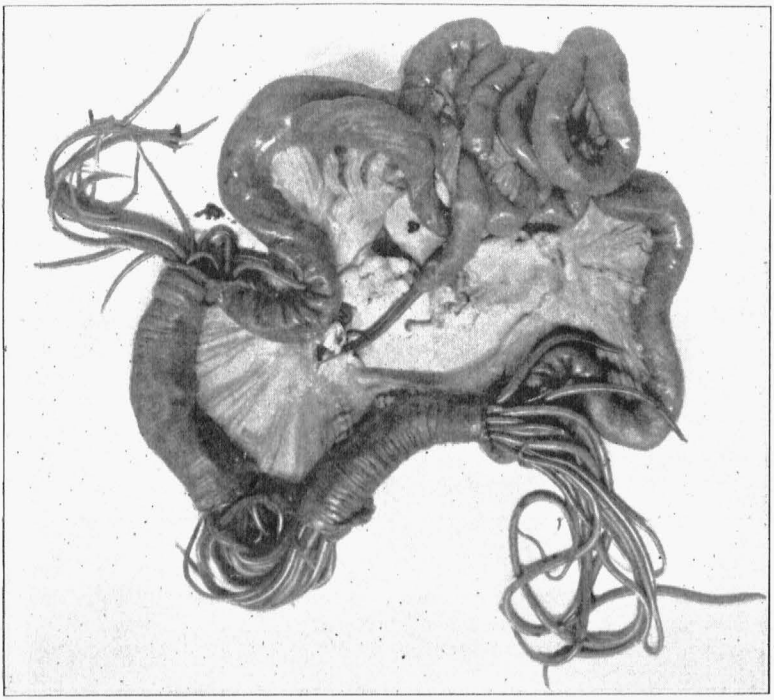

Fig. 1—Obstruction of Pig's Intestines by Worms.

Salt is a necessary element of the daily food supply. A properly balanced food-ration in the winter, or good pasturage in summer contains every other food element necessary for the growth and maintenance of health of the animal. The stock raiser who informs himself thoroughly concerning the food requirement of his animals, and pays proper attention to sanitation, will have but little need to administer medicines. Bulletins and circulars containing information on feeds and feeding have been prepared by the College of Agriculture and are supplied free on application.

Technical terms, for the most part, have purposely been omitted from this circular.

PARASITES AND PARASITISM

What are parasites?—Parasites are animal (or vegetable) organisms that obtain nourishment from a living host, either animal or vegetable. In this circular only animal parasites that infest an animal host are considered.

There are two main groups: external parasites, or those that live upon the surface of the body, such as lice, ticks and mites; and internal parasites, or those that live within the body, such as worms of different kinds found in various parts of the animal body.

How do animals become infested with parasites?—Infestation may take place through the medium of an infested animal, infested premises, bedding, and contaminated foods. Lice and scab mites may pass from one animal to another when the animals are in close contact, or a healthy animal may be infested from the harness, blankets, bedding or stalls of an affected animal.

An animal infested with mature worms, often passes thousands of worm eggs daily. These eggs hatch in a few days; especially under favorable conditions of warmth and moisture. The young worms live for some time in the bedding, or in the soil of the feed lots and pastures, or in pools or ponds of water, from which they are taken into the digestive tract of another animal, and grow to maturity.

Will worms of one species of animal attack an animal of another species?—Generally speaking they will not. There are a few kinds of worms which are common to several species of animals.

How do internal parasites obtain nourishment?—Some bury their heads in the lining of the bowels and suck blood, some attach themselves by the head and absorb nutrition through their body walls, and some have a complete digestive apparatus. In the last case food is taken in by the mouth and digested, as in higher forms of animals.

At what period in the development of parasites are they most injurious to their hosts?—Some internal parasites are especially harmful in the young or embryonic stage, since in this stage they are migrating and pass through the walls of the digestive tract into the blood vessels, and are carried to various organs of the body, in some of which serious irritation may result. At times the central nervous system is invaded causing attacks of dizziness, or spasms commonly called "fits." In other cases the blood supply to important organs is blocked, and serious results occur. Or the lungs may be the seat of the invasion and a severe bronchitis or pneumonia may result. Some of these wandering parasites are scarcely less harmful when they have reached the mature stage. Some other parasites do more harm in the adult stage than in the younger stages by their larger mass, or more toxic influence. But in either stage, old or young, all parasites abstract from the host considerable nutriment which it greatly taxes the host to supply.

Young animals are more susceptible to parasitic infestation and have less power to withstand the harmful action of the parasites and their poisonous excretions. Hence the liability that the young animals will become stunted in growth from severe parasitic infestation.

What is the form and size of the intestinal parasites?—The intestinal parasites most commonly found are those known as round worms, pin worms and tape worms.

The common round worms vary in size in different animals. They occur most frequently in the pig and horse and vary in size from 5 to 15 inches in

length. In the horse they may attain the diameter of a pencil. They are white, and pointed at both ends. They inhabit the small intestines.

Pin worms vary from one inch to several inches long and are much smaller in diameter than round worms. One end is usually somewhat blunt. They inhabit the large intestines.

Tape worms are flat and jointed. They vary in length, according to variety, from a fraction of an inch to many feet; and are generally found in the small intestines.

Is a small number of worms detrimental to an animal's health?—The effect of worms upon an animal is usually in direct proportion to the number present. While a few worms apparently cause no serious harm, conditions often arise that favor their rapid propagation; and they then become a menace to their host.

What conditions favor the development of parasites?—Limited quarters, and overstocking with a large number of animals favor the propagation of parasites. The healthy animals become infested from those which harbor the parasites. A single female worm will produce many thousand eggs.

Damp and poorly ventilated buildings, ponds with drainage from barn yards, ill-kept feedlots, and poorly drained pastures are conditions favorable for hatching the eggs of parasitic worms and for keeping alive the young parasites.

How long do pastures retain such eggs or parasitic embryos?—Probably only a few months if on well drained unshaded pastures, free from ponds, or boggy places. Wet pastures, and shaded timber pastures may be unsafe for several months, or even for a year or more.

What are the symptoms of infestation with internal parasites?—Symptoms vary, depending upon whether the invasion takes place gradually over several weeks, or whether it is acute. The invasion is usually slow. The animal often has a good appetite in the early stages of infestation but fails to gain in weight, or may even lose weight. The hair has a tendency to stand erect. The skin becomes rough and dry. Pigs may be restless, affected with cough or thumps. Nervous symptoms may be exhibited by convulsions, commonly termed "fits". Horses may eat their bedding. The bowels are often loose, especially if large numbers of worms are present. The mature and half-grown worms may often be found in the dung.

Do animals often die from the effects of parasites?—A sudden severe invasion with parasites may cause animals to die in large numbers, and such invasions have been mistaken for some acute microbic or toxic disease, such as cholera among hogs, anthrax in horses, or fodder poisoning. Worms sometimes plug the intestines to such an extent as to cause inflammation and death. In other cases the blood vessels may be invaded, with serious results.

The economic damage which results from loss in thrift and from permanently stunted growth is probably greater than the direct loss by death. Parasites weaken the animal's vitality and often prepare the way for fatal attack by other diseases.

INTERNAL PARASITES OF HORSES

At what season of the year are horses most likely to harbor worms?—Colts may have them any season. Mature horses are more often infested in late fall and winter.

How may one know when a horse is harboring worms?—The general symptoms are good appetite, failure to make proper gains, hair rough and dry, and discovery of worms passed with the dung.

How may horses be treated for worms?—The following remedies are recommended:

FORMULA 1.

Tartar emetic in two- to three-dram doses, once daily for three or four days. This is best administered mixed in a bran mash.

FORMULA 2

Powdered nux vomica	2 ounces
Powdered gentian root	4 ounces
Powdered areca nut	6 ounces
Sodium chloride	4 ounces
Arsenious acid	2 drams

Dose.—One teaspoonful to every 250 pounds weight of animal.

Directions.—Treatment with Formula No. 2 should be preceded by withholding all bulky food for 24 to 48 hours. Give the medicine with ground feed, or sprinkle it over dampened grain. Repeat the dose night and morning for one week, allowing very little bulky food during the treatment.

What are "bots", and are they hurtful to horses?—The bots or grubs in the stomach of the horse are not worms, but a stage in the development of the "nit-flies" or bot-flies which are so troublesome to horses in the summer time. The bot-fly deposits eggs in large numbers on the hairs of the legs where the animal can lick them off and swallow them, and on other parts of the body—for instance under the throat and along the underline of the belly, where, in the case of a brood mare, the colt finds additional sources of infestation. The newly hatched grub on reaching the stomach attaches itself by a pair of hooks or barbs to the dense and somewhat insensitive lining of the first portion of the stomach, and not, except rarely, to the sensitive secreting portion of the stomach. The bots, as long as they remain attached to the insensitive portion of the stomach do not cause much mechanical irritation; but perhaps do interfere to some extent with the thrift of the host from toxic excretions if present in large numbers.

When the bots are "ripe" they release their hold on the stomach and pass out of the body with the dung. They burrow into the soil and in a few weeks the grub is transformed into the bot-fly.

Horses which run on pasture during the summer, especially the young and old, may become infested with bots to an injurious extent. These may be eliminated by giving one-half ounce carbon disulphide in a capsule. This remedy had best be given by a veterinarian who has had experience in administering capsules. Carbon disulphide is an active poison and must be used with caution.

LICE ON HORSES AND CATTLE

How may horses and cattle be rid of lice?—Kerosene emulsion is very effective. This may be prepared in small amounts by dissolving one-half bar of hard soap in two quarts of boiling water. To this is added one quart of

kerosene, stirring briskly. Dilute with three to four gallons of water and use as a wash. The emulsion may be left on, or may be washed off after about thirty minutes. It should not be used when there is danger of chilling the animal.

Creolin, lysol, or liquor cresolis compound, may also be used. Four ounces of the chemical, which is approximately three-fourths of a teacupful, mixed with a gallon of water should be the proper strength. These treatments should be repeated at intervals of about ten days in order to kill any parasites which are hatched since the previous treatment. Two or three applications will usually be found sufficient.

Combing the hair with lard and kerosene oil, equal parts, is also effective. In the spring of the year, clipping the hair of the animals will greatly facilitate the treatment.

WARBLES IN CATTLE

What causes the warbles or knots which appear on the backs of cattle?—These knots or tumors are caused by a grub or bot larva in the loose tissue beneath the skin. These grubs in the back form a stage in the development of the "ox-warble-fly", which is a fly somewhat like the nit-fly of the horse. These flies deposit their eggs upon the animal during the warm days of early spring. When making their attacks the cattle may be observed with their tails elevated, running about the pasture in their endeavor to escape the pests. The young grubs bore their way through the inner lining of the oesophagus, or other parts of the digestive tract, and travel farther into the loose tissues underneath the skin. Some of the grubs perish, but some reach the back of the animal and produce the knots or warbles. It is thought that this grub, when recently hatched may also penetrate the skin at the roots of hairs, or through a puncture made by some blood sucking fly.

During the warm days of spring, the fully developed grubs emerge through openings which they have made in the skin, fall to the ground, and burrow into the soil or barnyard litter, where in a few weeks they are transformed into warble flies, which soon begin another cycle of propagation.

How may warbles in cattle be treated?—When the grubs have become sufficiently developed that the small tumors in which they are lodged may be easily felt, the retained embryo may be destroyed by the application of a little kerosene oil, or better a little mercurial ointment at the summit of the swelling. If the grub is about matured it may be squeezed out and destroyed. There is some danger in the forcible squeezing of warbles which are not fully developed as the sac containing the larva may rupture internally, liberating toxins poisonous to the animal, sometimes with fatal results.

WORMS IN HOGS

What are the symptoms of wormy hogs?—Unthriftiness, stunted growth, rough dry hair, diarrhea, cough, and thumps may indicate worms. The passage of the worms in the dung often occurs. A post morten examination of an unthrifty pig frequently shows a worm infestation of the intestines with the long round worms, or minute short thread-like worms may be found in an irritated stomach. These findings are indications for treatment of the entire herd.

How should hogs be treated for worms?—If hogs are properly handled they are comparatively easy to rid of worms; or at least gross infestation may

be prevented. The following formulas and methods of treatment are recommended:

FORMULA 1.—OIL OF WORM SEED

Oil of chenopodium (oil of worm seed).....1 ounce
Castor oil.....8 ounces
Mix

Dose.—One-half ounce per 50-pound pig. This is sufficient for 18 pigs of about 50 pounds weight.

Directions.—Prepare the animals for treatment by fasting 12 to 24 hours. Have an assistant hold the pig by the ears. Give the medicine with either a tablespoon or a dose syringe. The ordinary tablespoon holds approximately half an ounce. The pig may be kept from biting on the spoon or syringe by holding a blunt stick between the teeth on one side of the jaw, or a regular speculum for this purpose may be purchased. If the spoon is used, as it is being withdrawn from the animal's mouth, it may be wiped against the lower part of the snout in such a way as to insure the animal getting all the medicine; otherwise much will adhere to the spoon.

If a syringe is used the medicine must be deposited well back on the base of the animal's tongue. On account of the heavy nature of the castor oil, the spoon method will be found most convenient.

Castor oil and oil of worm seed have good keeping qualities, and it will often be found economical to mix larger quantities of these drugs.

One pound of oil of worm seed may be mixed with one gallon of castor oil, which makes the same strength of mixture as the preceding, and would keep for several years. Prepared in this manner the individual dose may often be reduced in cost to one-half or one-third of what it would cost if prepared in small amounts.

FORMULA 2.—SANTONIN AND CALOMEL

Santonin.....1 dram
Calomel.....2 drams
Powdered corn starch.....2 drams
Mix, and fill into twenty capsules, 15 grains each.

Dose.—A 15-grain capsule filled to capacity with this mixture will contain the proper dose for a pig weighing from 25 to 100 pounds.

Directions.—Prepare the pigs for treatment as directed in Formula 1. Administer the capsules with a pilling gun, taking care to deposit the capsule just over the base of the tongue. After treating pigs for worms, feed should be withheld for about 6 hours.

Caution.—Pigs are sometimes injured by capsules if they are deposited too far down in the throat. They may lodge in a pocket at the back of the throat, where the pig cannot swallow it, and cause serious inflammation.

FORMULA 3.—TURPENTINE

Dose.—One-half ounce (or one tablespoonful) per pig. One pint of turpentine will be sufficient for one dose for about 30 pigs weighing from 50 to 100 pounds.

Directions.—Prepare pigs for treatment as recommended under Formula 1. Give one tablespoonful of turpentine, per 100 pounds weight mixed with a

light feed of thick mash or skimmed milk. Repeat for three successive feeds. Follow last dose with one ounce of epsom salts per 100 pounds weight, mixed with slop.

There is no danger of overdosing with turpentine, since if too much is given, the pigs will refuse to eat the mixture.

FORMULA 4.—POWDERED COPPER SULPHATE (BLUE-STONE)

Dose.—One teaspoonful per 100 pounds weight, or one ounce to every eight pigs of 100 pounds weight each. (Smaller pigs in proportion.)

Directions.—Give in a thick mash (a mash of corn chop and bran is preferable) morning and evening, after having fasted the animals for 24 hours. Give the following morning, mixed with the slop, one ounce epsom salts per 100 pounds weight.

FORMULA 5

Another method of using copper sulphate which has proven successful is as follows: The total weight of the pigs to be treated is first estimated. For each 100 pounds weight 40 grains of powdered copper sulphate is mixed with the slop or mash which the animals receive. This is repeated twice daily for a period of five days.

For example, 25 pigs weighing 50 pounds each would total 1,250 pounds. Forty grains per hundred would be 500 grains or approximately one ounce; therefore one ounce of copper sulphate would be needed in each feed which the 25 pigs received. Ten ounces would be sufficient to treat the 25 pigs for five days. The required amount of medicine may be divided up into ten doses or the whole may be mixed with ten measures of feed. One measure of the mixture being added to the ration at each feeding.

Formulas 3, 4, or 5 are sometimes desirable because they are cheap and easily obtained. Turpentine and copper sulphate when used as previously directed have been found safe and effective worm remedies for the hogs.

A few reports indicate that turpentine and copper sulphate have occasionally produced abortion in pregnant sows; but no conclusive evidence shows that such is the case.

Pregnant sows are less frequently infested with worms. When treatment is necessary, Formula 1 or 2 is recommended.

Many swine raisers make a practice of keeping equal parts of salt and ashes or equal parts of salt, ashes and charcoal in the pig lots for the hogs to eat at will. These mixtures, although not very efficient as a treatment for worms, are of value as preventives, and such a mixture as salt, ashes and charcoal, if kept accessible to the hogs, will be of value in preventing worm infestation, and furnishes the hog with important food elements necessary to its growth.

While the foregoing treatments will be found serviceable, it is much better to prevent infestation of the herd than to be compelled at times to give drastic treatment, after the herd is grossly infested.

How may worm infestation in swine be prevented?—Water is a very common and frequent carrier of swine parasites. A water supply free from parasitic contamination should therefore be provided. Ponds with surface drainage from the hog lots should be rigidly avoided. The litter in the feeding lots should be scraped up and hauled out upon the fields at frequent intervals. The liberal use of fresh slaked lime about the pens and feeding places will help to reduce parasitic infestations. The feeding places should be changed at

frequent intervals if they cannot be kept in fairly good sanitary condition. This is also advisable in the case of pastures that cannot be disinfected, and where a large number of pigs are raised together. The plowing and cultivating of old feed lots and infested pastures is helpful in the control of parasites.

A method of worm prevention for swine worked out by the U. S. Bureau of Animal Industry and known as the McLean County System is especially commended as worthy of trial by every swine raiser. The important feature of the method is this: *Do not allow the newborn pigs to become worm-infested during the first* 14 *to* 16 *weeks of their life.*

How can the newborn pigs be kept from the worms?—The answer is found in the following paragraphs on spring and fall pigs.

SPRING PIGS

Farrowing pens.—Before farrowing time the pens should be thoroughly cleaned, all litter removed, and the pens scrubbed with boiling water and lye, using one can of lye to five gallons of water. A few days before farrowing the sows are given a thorough washing which serves to remove any worm eggs which may be present on the skin. The sows are then put into clean pens. If this precaution of cleaning the skin of the sows is not taken, the first few mouthfuls of milk which the newborn pigs swallow, may contain thousands of worm eggs and germs of other diseases.

The sows and pigs are not allowed out of the farrowing pens until they are taken to pasture, which is usually about two weeks after farrowing. A double crate or two single crates may be used for this purpose, one for the sow and the other for the pigs. Moved in this way, the animals are prevented from becoming infested from the soil in the vicinity of the farrowing pen.

Special pasture for the sows and young pigs is provided and should be a field that has been under cultivation and sown at the proper time to a suitable forage crop. There should be individual shelter houses for each sow and her litter in the pasture, and water is supplied by piping or hauling it to them. No other hogs should have access to this pasture nor should the pigs be allowed to run back from the pasture to barn lots or hog yards.

Temporary shades should be provided for protection against the summer sun. Care should be taken, however, to prevent the soil from becoming worked up into a dust bed. This can be prevented by smoothing off the surface of the ground under the sheds and stretching over the floor small-meshed chicken wire, stretching tightly and tacking to a wooden frame-work of two by fours nailed to the posts supporting the shelter roof. The roof of rough boards should be high enough to permit good ventilation beneath.

In the use of the same pasture at the same time for several sows and litters, care should be taken to separate litters of different ages by a partition fence so that litters which are considerably older than others may not rob the younger pigs of the milk that belongs to them.

FALL PIGS

If not farrowed too late, fall pigs may be handled according to the same system with a few exceptions. If the sows have been running on pasture and are free of mud and filth, they may be transferred directly without washing to the special pastures and the farrowing done in the individual houses in this pasture.

Pigs which are kept away from contaminated places until they are at least four months old or until they weigh about 100 pounds, even though exposed to infection, are not likely to suffer seriously from worms.

While the foregoing paragraphs contain the essential points of the McLean County Method, a few of the less essential points have been omitted, and a few other practical points have been added.

LICE ON HOGS

How may hogs be rid of lice?—A very common method of treating hogs for lice and one which is effective is to bunch the animals together in a small enclosure and sprinkle them with a mixture of crude oil or used motor oil. Either of these oils may be thinned with the necessary amount of coal oil to make it spread easily. The animals should be allowed to mix together for a short time in order that the oil may be distributed all over their bodies when crowding about. It is advisable to administer the treatment in the latter part of the day, for if treated early and turned out in the sun, the animal's skin may blister.

Any of the dip preparations may be used for treating pigs for lice. One pint of dip diluted with three gallons of water may be used for this purpose. If a dipping tank is used the emulsion dip is recommended.

FORMULA.—EMULSION DIP

Hard soap	8 oz.
Kerosene oil	4 gallons
Water	2 gallons

Directions.—Dissolve the soap in boiling water and while still hot, add the kerosene, stirring the mixture rapidly for about ten minutes. One gallon of this mixture is then mixed with 8 to 10 gallons of water.

Treatment for lice should be repeated in about ten days.

The preparation may be used in a dipping tank or may be sprinkled over the hogs with a spray pump.

The dip should be used toward evening or on cloudy days as the hot sun may blister the animal's skin if the oil has not evapotated.

The emulsion dip is probably more efficient in destroying nits than the commercial dip. In either case the treatment should be repeated in a week or ten days to destroy any lice which may have hatched since the previous treatment.

WORMS IN SHEEP

Do parasites attack sheep?—Sheep are subject to invasion by many varieties of parasites, especially if they are pastured on low ground, and if the same pastures are used for a number of years in succession.

What are the symptoms of worms in sheep?—Worms in sheep are shown by loss of condition, pale color of the skin and membranes about the eye, diarrhea and weakness. Puffy swellings are often noticeable under the lower jaw in advanced cases, and post mortem examination reveals worms in the fourth stomach.

Whenever sheep die from unaccountable causes a careful post mortem examination should be made for worms. The stomach worm is very small,

scarcely larger than an ordinary pin and of a reddish-brown color. It inhabits the fourth compartment of the sheep's stomach or that part of the stomach which attaches to the small intestines.

What is the most serious worm enemy of sheep?—Of the internal parasites the stomach worm heads the list for its wide distribution and destructiveness. Other pin worms and various species of tape worms, also are often present in large numbers.

How may stomach worms be eliminated?—*Copper sulphate treatment*—Copper sulphate has proven to be a cheap and effective remedy for treating sheep affected with stomach worms. This drug, however, is an active poison, making it necessary that the strength of the solution and the dosage be carefully gauged.

The copper sulphate solution is used in the strength of one per cent.

The following formulas will meet the average needs:

FORMULA 1
(Ready for use.)

Copper sulphate.....1⅓ oz.
Water.....1 gallon
This is sufficient to treat about 40 sheep.

FORMULA 2.
(Ready for use.)

Copper sulphate.....4 oz.
Water.....3 gallons
Sufficient for about 120 sheep.

FORMULA 3.
(Must not be used until diluted as directed below.)

The following is sufficient for about 500 sheep:

Stock solution.—Copper sulphate.....1 pound
Water.....1 gallon
Boil together until copper sulphate is all dissolved.

For use.—1 pint of this stock solution diluted with water sufficient to make 1½ gallons

How is copper sulphate solution prepared?—As copper sulphate has a very corrosive action on metal, solutions of this chemical must be made in an earthen or glass container or one which is porcelain enameled. The required amount of copper sulphate is first boiled in a small amount of water until it is dissolved, after which it is sufficiently diluted to bring it to the required strength.

Except in the case where a stock solution has been prepared, the medicine should be made up fresh for immediate use.

If copper sulphate crystals are exposed too long to the air they become oxidized and turn grey in color and their medicinal value is lost. It is important, therefore, when preparing the solution that only fresh, bright, crystals be used.

Directions for giving dosage.—One ounce of the solution is sufficient for each 20 pounds of sheep's weight, or a sheep weighing 60 pounds requires a

dose of three ounces, smaller sheep in proportion. Sheep weighing more than 60 pounds, however, need not have the dose increased much above three ounces.

Methods of dosing.—The medicine may be given with a long-nosed bottle. The ordinary pop bottle will be found serviceable. The sheep should be set on its rump by an assistant while the medicine is being given.

Another method consists in the use of a piece of rubber tubing about 2½ feet long which is fitted to a small funnel. The sheep is held in a standing position by an assistant, a small block of wood through which a hole has been bored large enough for the passage of the tube is placed between the animal's jaws. The tube is then passed down the animal's throat far enough to carry the medicine below the entrance to the wind pipe. The proper dose is then poured into the funnel and allowed to run into the sheep's stomach.

A third method consists in the use of a dose syringe with a short piece of rubber tubing 4 to 6 inches long to lengthen the stem. The syringe is then used to inject the medicine into the animal's mouth.

Whatever method of treatment is used, the animal should be kept from food and water for about four hours after dosing.

In treating a flock of sheep which are seriously infested, better results may be obtained by repeating the treatment after an interval of 24 hours, allowing the animals access to water for a short time after about six hours following the first dosage, but no solid food should be given until several hours after the second treatment.

Note—As over-dosing of copper sulphate may kill the sheep, a graduate or graduated bottle should always be used for determining the dosage.

The following preparation is a medicated salt that serves as a worm preventive and may be kept where sheep have free access to it:

Powdered iron sulphate	2 pounds
Powdered sulphur	2 pounds
Powdered copper sulphate	2 pounds
Salt to make	100 pounds

How may worms in sheep be prevented?—Change pastures frequently. Supply the animals with spring water, running water or water from wells protected against contamination. Exercise care in the purchase of new stock that infested animals may not be introduced into the herd. Keep salt accessible to the animals. The medicated salt recommended will be found useful in preventing infestation.

Parasitism is the greatest menace to the sheep industry and the man who would make a profitable business of raising sheep, unless especially favored by natural conditions of water, soil and drainage, must be on constant guard against the invasion of his flock by parasitic enemies.

GRUBS IN SHEEP'S HEAD

What is the origin of grubs in the head of sheep?—Just as bots in a horse's stomach, or the warble grubs in the back of a calf, are not worms, but the grub stage in the growth of a pestiferous fly, the grubs in the head of sheep are likewise not worms, but the "grub stage" in the development of the bot-fly of sheep. The fly deposits larva around the margins of the nostrils of the sheep. The young maggots then crawl up into the open sinuses or cavities of

the head, where they remain until they have reached their mature stage, which occurs in the spring or early summer. The grubs then emerge from the nose, burrow into the soil, and in a few weeks are transformed into the sheep gad-fly."

What treatment is recommended?—Preventive measures are especially important in the control of these pests, on account of the difficulty of dislodging them from the cavities where they are harbored. No medicines introduced into the nose are very effective, and they are more likely to give unnecessary pain and discomfort to the sheep than relief from the grubs. The operation of trephining or boring holes through the facial bones into the sinuses, and removing the grubs by means of forceps, or destroying them by injecting irritant drugs, is too difficult and unprofitable to be recommended to flock owners and herdsmen.

Shade as a preventive.—If, during the heat of the day when the grub flies are most active, the flock has access to a cool, darkened stable, such as may be had in basement barns, the worry from the gad-flies, and infestation with the grubs will be prevented to a considerable extent.

What treatment is recommended?—Treatment is preventive. Smearing the nose of the sheep with tar at intervals of three or four days during the summer months will repel the attacks of the fly and prevent deposition of larva about the nostrils. An old glove kept for the purpose will be found useful for applying the tar to the nostrils.

Sheep which are infested with grubs in the head have a tendency to run down in condition. This should be counterbalanced by good care and feeding until the grubs naturally drop out, which occurs during the late winter and early spring.

What are "gid" parasites of sheep?—These are small bladder-like bodies sometimes found in the brain of sheep. They contain the head and the beginning of segments of a tape worm.

How does the "gid" worm gain access to the brain of sheep?—The mature stage, that is the long, flat, tape-like worm exists in the intestines of infested dogs; and, from time to time, ripe segments or joints of the worm are excreted with the dung and attach to the pasture grasses. These tapeworm segments are full of eggs, and if eaten by a sheep the freshly hatched embryo worms migrate through the intestinal walls into the surrounding tissues, or into the blood vessels and are carried to various parts of the body. Some develop cysts in the intestinal fat, some attach to the liver, and occasionally some are carried to the brain, where the gid-cysts develop. The pressure on the brain, in the latter event, causes symptoms of "giddiness", or turning in circles.

How may the "gid" in sheep be treated or prevented?—The surgical operation of trephining the skull and removing the cysts with forceps is even more difficult and less successful than the "grub" operation, and neither is advised. Prevention, however, is feasible; and consists in keeping dogs out of the sheep pastures, unless the dog is free from tapeworm infestation (See treatment of dogs for tape worms, page 16).

No medicinal treatment is serviceable for destroying the gid parasite in the brain.

What is nodular disease of sheep?—This is a parasitic disease in which wart-like knots or nodules are formed in the outer coat of the large and small intestines. In the early stages of growth, these nodules contain a cheesy matter of greenish color. The old nodules are hard and gritty.

What produces the nodules?—The cause of this disease is a very minute, slender round worm scarcely visible to the unaided eye. They burrow in large numbers from the inside of the intestine, and set up an irritation in the intestinal wall that causes the growth of the nodules.

How may these parasites be combated?—Treatment of the sheep after the nodules have developed will not remove the nodules, nor destroy the deeply imbedded worms; but no doubt the systematic use of the blue-stone treatment, as recommended for stomach worms, will also prevent any degree of infestation from the parasitic worms that cause nodular disease.

This result is obtained only by killing the embryo worms before they have penetrated into the walls of the intestines. Treatment of the entire flock once a month should prove helpful. Some degree of success has been reported from raising the lambs by the "dry lot method."

EXTERNAL PARASITES OF SHEEP

The external parasites of sheep are lice, the so-called sheep tick, and the scab mites. These parasites can be controlled by proper dipping in a solution of one of the several commercial dip preparations that have been authorized for official dipping by the U. S. Bureau of Animal Industry. A list of these tested and approved dips can be secured by writing to the Department of Veterinary Science, Missouri College of Agriculture. The list is changed from time to time and it is best to write for the latest approved list when in need of a reliable dip. The "lime-and-sulphur dip" is an old standard preparation and very reliable for destroying not only the lice and ticks, but also the more deeply seated scab mites.

What are the symptoms of scabies in sheep?—The first symptom usually noticed is a restlessness of the affected animal. And on account of the irritation of the skin, due to the attacks of the scab mites, the sheep rub against fence posts or other objects and bite at the wool over the affected region. The animal also attempts to scratch the affected part with the hind feet, and thus wears away a portion of the wool. A close examination of these parts will show a reddened condition of the skin, and the oozing of serum, and if the disease has somewhat advanced, scabs will have formed, and there is a loss of wool over the affected part as the disease progresses. A veterinarian should be called to make a careful examination for the parasites, since the owner or herdsman is likely to overlook the presence of the scab mites on account of their minute size. If a veterinarian is not available, however, the owner should be able, by using sufficient time and effort, to arrive at a diagnosis. Pull out, or better scrape out with the large blade of a pocket knife a bit of wool with the scabs attached. Place the scab and bit of wool in the palm of the hand, separate the fibers as carefully as possible and examine the wool fibers close to their junction with the scab. The warmth of the hand will enliven the scab mites, and if present they will be observed to move. They are exceedingly tiny, white objects, whiter than the wool and their movements aid in their detection. A low power hand glass assists greatly in detecting these mites. Another method is to dust out a portion of the scab on a piece of black paper or black cloth, and watch for movements of the mites against the black background. If the mites are found, report the same to the nearest deputy state veterinarian in order that he may look into the origin of the infection and take measures to prevent its futher spread among the flocks of the neighborhood.

WORMS IN CHICKENS

Are chickens attacked by worms?—Chickens suffer from worms more frequently than is generally supposed.

What are the symptoms?—Poor condition, drowsiness, weakness and often death. Post mortem examination reveals the parasites in the intestines. Worms in chickens are usually of the round variety and from two to three inches long.

How may these worms be eliminated?—The following formulas are recommended:

LYE TREATMENT

Oats	2 quarts
Wheat	2 quarts
Lye	1 tablespoonful

The spoon should be slightly rounded with lye.

Directions.—Dissolve the lye in one pint of water. Put the oats and wheat into a vessel which will hold about three gallons. Add just water enough to cover. The lye solution is then added and the mixture is placed over a slow fire to heat for about 2 hours. Prepare the chickens for treatment by withholding food for 24 hours, after which the lye mixture may be given, allowing the chickens to partake freely.

COAL OIL TREATMENT

Mix sufficient kerosene oil with cracked corn or corn chop so as to be slightly dampened. After the chickens have been fasted for 24 hours they will eat enough of the mixture to expel the worms. Unless the weather is warm the chickens should be protected against cold after this treatment.

For chickens so badly infested with worms as to have little appetite, the following will be found useful.

Santonin	10 grains
Powdered areca nut	3 drams

This may be fed in a small amount of damp mash or made into ten pills and each chicken dosed separately.

The occasional dosing with epsom salts will expel many worms.

Give one-half teaspoonful epsom salts per chicken, or one tablespoonful for every ten chickens, or one ounce to every ten grown chickens. Smaller chickens should be dosed according to size.

These treatments will be found effective for worms of other domestic fowls.

GAPES IN CHICKENS

What causes gapes in chickens?—Gapes is caused by worms in the windpipe. The chickens pick up the larva of the parasites in the damp earth. The parasites find their way into the trachea where they attach themselves and produce the irritation which causes the chicken to sneeze, or on becoming larger, fill the wind pipe to such an extent as to cause the chicken to gasp for breath.

What treatment is recommended?—Place the affected chicken in a pen or room which has been sprinkled freely with slaked lime. Add a few drops of turpentine to the ration. A feather may be dipped in turpentine and passed

down the chicken's wind pipe in an effort to dislodge the worms. Some owners report considerable success by removing the worms with a twisted horse hair or one of the specially prepared instruments which are on the market.

Prevention is of greatest importance. Lime the soil where gapes-infested chickens have run. Confine the chickens so they cannot run under out-buildings and in shady or damp places, since it is in such places that the eggs and embryos of the parasites live. A chicken in which the symptoms are very severe had better be killed and burned. By confining the unaffected chickens in a yard which is frequently sprinkled with a liberal amount of freshly slaked lime, the disease can usually be checked and further trouble prevented.

LICE ON CHICKENS

How may chicken lice be controlled?—Spray roosts with kerosene oil, kerosene emulsion, Kreso Dip 2 to 5 per cent, or Liquor-Cresolis Compound 2 to 5 per cent.

Four ounces to a gallon makes about a 3 per cent solution.

SODIUM FLUORIDE TREATMENT

Sodium fluoride is a very effective remedy for treating chicken lice. It may be obtained from the druggist. The chicken is held by the legs and a pinch of sodium fluoride is put in its feathers, at several points about the bird's body. Along the back, under the wings and about the vent are the points which the lice most commonly frequent.

A serviceable dusting powder may be made as follows:

Dip.....one part
Gasoline.....three parts
Plaster of paris added until a powder is obtained dry enough to sift.

Hold chickens by the legs with head down and dust freely into the feathers. If the chickens are held over a box, the powder which shakes off in the process of dusting may be used on the next chicken. This makes the treatment very inexpensive.

The preparation should be used fresh or kept in air-tight containers, otherwise it will lose much of its effectiveness.

LICE OR FLEAS ON DOGS

Prepare a coal oil emulsion wash as directed for treating horses for lice. The solution may be left on the animal or washed off after an interval of fifteen to twenty minutes.

For small pet dogs, pyrethyum powder may be dusted through the hair. Combing the hair with spirits of camphor or with rubbing alcohol is also effective. The dog should be placed on a paper when treated so that the fleas and eggs which drop out of the hair may be gathered up and destroyed.

WORMS IN DOGS

Treatment for round worms.—Fast the dog for 12 hours. Give one drop oil of wormseed for each 2 pounds weight, mixed with caster oil. For small puppies one teaspoonful of castor oil may be sufficient. For larger dogs one-half to one ounce of the oil may be given.

Treatment for tape worms.—Prepare the dog for treatment by fasting for 12 hours. Give two grains of powdered areca nut to each pound weight. The medicine may be mixed with a little syrup or molasses and given with a spoon. In most cases the dog must be forced to take the medicine.