Sheep: the principal breeds: brief discussion relative to sheep husbandry in Louisiana: some of the more important local parasitic ailments: results of experiments with nodular disease of the intestines

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SHEEP.

The Principal Breeds. Brief Discussion Relative to Sheep Husbandry in Louisiana. Some of the More Important Local Parasitic Ailments. Results of Experiment With Nodular Disease of the Intestines.
Louisiana State University
and A. & M. College.

Louisiana State Board of Agriculture and Immigration

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The Bulletins and Reports will be sent free of charge to all farmers by applying to Commissioner of Agriculture, Baton Rouge, La., or to the Director of the Station, Audubon Park, New Orleans, La.
Dr. W. C. Stubbs, Director.

Dear Sir:—I hand you herewith the MMS. of a bulletin on Sheep, covering the chief improved breeds; a brief discussion of the possible success of sheep husbandry in the State; several of the more important local internal parasitic diseases; and the results of an experiment, as yet incomplete, with Nodular Disease of the Intestines.

It is hoped that the information given will be found of use to those already engaged in sheep raising in the State, and that it may arouse a more general interest in the subject of sheep husbandry in those whose attention had not previously been attracted to it.

In the preparation of the bulletin, besides embodying my own personal observations and investigations, I have consulted the following literature: "Special Report on the History and Present Condition of the Sheep Industry of the United States" (U. S. Department of Agriculture, 1892); "Animal Parasites of Sheep" (Dr. Cooper Curtice, U. S. Department of Agriculture); "Parasites and Parasitic Diseases of the Domestic Animals" (Neumann); "Horses, Cattle, Sheep and Swine" (Curtis); "The Study of Breeds" (Shaw); "The Sheep" (Rushworth); "Live Stock of the Farm" (Pringle); "Nodular Disease of Sheep" (Paper by Dr. M. Jacob, Tenn. Ex. Sta., in Report of Proceedings of Am. Vet. Med. Association); "Nodule Disease of Sheep" (Article by Dr. M. H. Reynolds, Minn. Ex. Sta., in Am. Vet. Review) "Stomach Worm Disease" (Article by Dr. A. W. Bitting, Ind. Ex. Sta.). My thanks are due Prof. H. A. Morgan for assistance given in the experiment with nodular disease, and to the American Sheep Breeder Co., Chicago, for furnishing illustrations of the different breeds of sheep.

Respectfully submitted,  W. H. Dalrymple.

LOUISIANA STATE UNIVERSITY AND A. & M. COLLEGE.

Office of Experiment Stations,  Baton Rouge, La.

Hon. J. G. Lee, Commissioner of Agriculture and Immigration,  Baton Rouge, La.

Dear Sir—The disposition on the part of many of the planters of Louisiana to enter upon the sheep industry, has been so apparent
for many years that a bulletin covering the breeds of sheep, and the obstacles to the successful raising of them, is deemed eminently appropriate just now. At my request Dr. Dalrymple has written the within treatise, and embodied in it a series of experiments upon the insects detrimental to the raising of sheep in Louisiana, conducted upon the Experiment Stations. I ask that this bulletin be published as Bulletin No. 74.

Respectfully submitted,

WM. C. STUBBS, Director.

SHEEP.

THE PRINCIPAL BREEDS—BRIEF DISCUSSION RELATIVE TO SUCCESS OF SHEEP-HUSBANDRY IN THE STATE—SOME OF THE MORE IMPORTANT LOCAL PARASITICAILMENTS OF SHEEP—RESULTS OF EXPERIMENT WITH NODULAR DISEASE OF THE INTESTINES.

W. H. DALRYMPLE.

Being impressed with the possibilities of successful sheep-husbandry in Louisiana, provided it was undertaken in the right spirit and prosecuted in an intelligent and business-like manner, it is hoped that what follows in these pages may arouse, in our farmers and stock raisers, a keener interest in this valuable little domestic farm animal, and the possible benefits that may be derived from its more careful selection, breeding, feeding and development.

In his article on “The Sheep Husbandry of Kentucky, Tennessee, Alabama and Florida,” by Ezra A. Carman, which appeared in a “Special Report on the History and Present Condition of the Sheep Industry of the United States,” issued by the National Department of Agriculture in 1892, the author states that “It is doubtful if there is any other section of the United States that presents so many natural advantages for the successful and profitable raising of sheep as that bounded by the Appalachian Mountains on the east, and the Mississippi River on the west, and extending from the Ohio River on the north, to the Gulf of Mexico on the south. Possessing an equable climate, where the cold is not so severe during winter to make the feeding of sheep a necessity, nor the heats of summer so intense as to work a degeneration in the character of the fleece, it has been justly considered an ideal sheep country.” With all the natural advantages of cheap, good lands, well watered, and
pasturage unrivalled for its quality and abundance, Mr. Carman further states: "There is no section of the Union where sheep are fewer and more worthless, or where sheep husbandry is in a more deplorable condition, with exceptions to the statement to be found only in some parts of Kentucky and Tennessee. The sheep inhabiting this large section are scrubs of English and Spanish breeds, descended from those of the pioneer settlers, and have undergone no improvement at the hand of man, but have lived, propagated, and cared for themselves in spite of his indifference and neglect, and the voracity of his dog."

With the exception of a few sheep of the improved breeds to be found here and there for family consumption throughout the State, the foregoing statement is applicable to the sheep industry over the greater portion of Louisiana to-day, and to lift it from the "slough of despond" in which it is at present placed, will require, as in the case with any other business, education, careful observation, persistent effort, and close attention. The sheep raiser should have a sufficient knowledge of the laws of breeding to enable him to intelligently mate animals of the different breeds, should he desire to cross for the purpose of improving his flock, or bring about changes more desirable and more suited to the conditions of climate, soil, etc., of his immediate section, for there is no other of the domestic farm animals upon which climatic influences are so great. Pure bred animals of any of the distinct breeds, when removed to a locality where the soil and climate are quite different, will, in the course of two or three generations, gradually change their type. The quality of the wool is dependent upon the climate and soil not less than upon the breed. Generally speaking, the native sheep of a district have special qualities, the result of climatic influences, which render them, when improved by careful selection and breeding, or by crossing with some other strain, more profitable to keep than any other breed. The sheep raiser ought, then, to make himself familiar with the various breeds, and especially those most suited to his requirements, whether for mutton, or wool, or a combination of both.

In these days of vigorous competition in all classes of food animals, he should study the food crops most adapted to his soil and best suited to the feeding of his sheep, so that he may be able to push his animals, as rapidly as possible, into marketable condition.

Domestication has done for the Sheep what it has for the other animals of the farm. It has improved its condition as a commercial article, so to speak, but in working this transformation, it has lessened its powers of resistance against hardships possessed by its
wild progenitors, and made it more dependent upon man for its maintenance and development. Consequently, if we desire to reach, and keep abreast of the progress that is being made in this industry in other sections of the country, we will have to change the method which has hitherto so extensively prevailed with us, of permitting the animals to degenerate into veritable “scrubs” for lack of the necessary attention, to one of systematic improvement and development, with some specific object in view. Or, in other words, look upon and treat the sheep as one of the most profitable animals upon the farm, which, in reality, it is, when intelligently looked after and handled in a business-like manner.

BREEDS.

For convenience of description, the breeds of sheep may be divided into three classes, viz.: Shortwooled, middlewooled and long-wooled. In the first class are included the different varieties of Merinos, the Horned Dorsets, and the Cheviots. In the second class we have the Southdowns, Shropshires, Hampshires, and Oxfordshires; and belonging to the longwools, the Cotswolds, the Leicesters, and the Lincolnns.

AMERICAN MERINO.
To go into the history of the Merino Sheep would occupy more space than is necessary in a publication of this character, and as it is only a matter of historic interest would not be of any special benefit from an industrial standpoint. It appears, however, on the authority of Prof. Geo. W. Curtis, that the American Merino, with its various sub-divisions or families, has arisen from importations of importance made into this country, first by Col. David Humphreys, of Derby, Conn., in 1802, and from which have sprung the modern Atwoods, Dickinsons and Black-Tops; and second, by William Jarvis, of Vermont, in 1809-10, which consisted according to Stewart's "Shepherds' Manual," of 3,850 sheep of the flocks of Paulars, Negrettis, Aquierres and Montarcos, of Spain.

The Merino is by no means unknown in the South. In fact, is perhaps better known than any other variety of sheep. The following are the more prominent strains of the breed in the United States: American-Spanish, including Dickinsons, Black-Tops, Delaines, and Rambouillets.

For quality of wool, the Merino stands without an equal.
This breed, as the name implies, is a native of the county of Dorset, England. So far, this sheep is not so well known in the United States as some of the others, and, up to a somewhat recent date was, perhaps, unknown in the more Southern States. For the last few years, however, the North Louisiana Experiment Station has been testing the qualities and characteristics said to be peculiar to the breed, which should render it a very desirable animal. The chief peculiarity consists in the fact that, when the ewes are well kept, they will mate early, and produce lambs fit for the Christmas market. And, as the ewes mate again soon after lambing, it is not unusual for them to produce two crops of lambs in the year; and further, that it is not uncommon for them to bear twins, and even triplets, at a birth. The experience with this breed at the North Louisiana Station, although the representatives were only few in number, did not verify the peculiar characteristics attributed to it. Possibly the test was not a sufficiently conclusive one with reference to the breed as such, on account of the few representatives, and conditions of environment not altogether suited to them.

Both male and female have horns. The Dorset is a white-faced breed; has a tuft of wool on the forehead, and the legs are also white. As a breed they are hardy, gentle, and easily managed.
When well fed, wethers can be made to weigh, at two years old, from 20 to 25 pounds per quarter. The fleece is close and heavy; above medium in texture, the average weight of which is about 6 pounds. The males are said to be well able to take care of themselves when attacked by the “wandering cur dog”.

CHEVIOT.

This breed of sheep takes its name from the Cheviot range of hills situated partly in the County of Berwick, Scotland, and partly in Northumberland, the most northerly county in England. They now occupy a large extent of the mountain pastures in the South, as well as a portion of the better class of sheep-land in the north of Scotland. The Cheviots are without horns, although a “button”, or “scur”, is seen occasionally in a ram; they have white faces and legs, but sometimes show a slight tendency to light-dun markings; the neck and forequarter, which at one time were inclined to be light, have been improved in the best specimens of the breed. They are hardy and quiet; fatten readily on root and other crops, and the wethers at three years old generally weigh from 70 to 80 pounds or more, if forced with artificial food. The mutton is of superior quality. The ewes make excellent mothers,
and are very prolific, and the fleece averages from four and one-half to five pounds. The Cheviot was imported into this country about 1840, but is, as yet, comparatively unknown, except in a few localities, chiefly in the States of New York and Indiana, although small-sized flocks are said to exist in the majority of the States east of the Mississippi river and north of the Ohio and Potomac. They were first imported into Delaware County, N. Y., in 1838, by Robert Young, but their diffusion was very slow and gradual until after 1880.

SOUTHDOWN.

The native home of this Sheep is the chalk-hills or downs of the southern counties of England. "Small in size, but great in value", are the characteristics of this breed, and those features have been acquired solely through careful selection and culture, for the original Southdown had light forequarters, narrow chest, and long legs, which, however, have been corrected, till the modern animal is a model of compactness and symmetry. They are hornless, with brown or grey faces and legs; close fleece, which is short in the staple, fine and curling, and weighing about from 3 to 4 pounds. The mutton is of the finest quality. They are a hardy sheep, easily kept, and fatten readily. At 12 to 15 months old Southdown
wethers should average 18 to 20 pounds per quarter, and at 2 years old, from 25 to 30 pounds. The ewes are very prolific, and make good mothers. Next to the Merino, the Southdown is the most widely-known breed of sheep in America; finding great popularity in the West and Middle States, and is also quite a favorite in the South. Where mutton is the prime object, the Southdown is hard to excel. The breed was imported into this country about the beginning of the 19th century.

SHROPSHIRE.

This important breed was not imported into the United States until 1855, but has, during the past 20 or 25 years, been in such increasing demand, that they are now said to be more numerous than any of the other breeds. They are hornless, with dark greyish or brown faces, the wool coming well down to the eyes. The legs are almost black. The fleece is close-set, finer, and longer in staple than the Southdown, and averages about 7 pounds; they have greater size than that breed, and in quality they are not much, if any, inferior. They carry a large proportion of lean meat to fat; are light in offal, and, with good treatment, they are marketable at from 11 to 14 months old, weighing from 20 to 25 pounds, or over, per quarter.

In grading up the middle-wools on the southwestern ranges,
Shropshire rams are said to be giving satisfaction. It is claimed for the breed by English authorities, that they seem to possess the faculty of thriving under varied conditions of soil and climate. The ewes are good sucklers, and very prolific; 100 ewes not infrequently rearing 160 to 180 lambs.

HAMPSHIRE.

The present improved Hampshire Down has been produced by crossing ewes of the old breed of Hampshire and Wiltshire with Southdown rams, combined with selection and feeding. They originated on the chalk formations of Berkshire, Hampshire, Wiltshire, and Dorsetshire, England.

This is the largest of the Down families proper. It is hornless, with dark face and legs, and often a Roman nose. Lambs of this breed attain a greater weight than those of any other breed at the same age. At the Smithfield (London) Fat Stock Show, in 1883, the champion plate, for the best pen of fat sheep in the show, was won with a pen of Hampshire lambs, 10 months old, and averaging 207 pounds live weight; their dead weight being 136 pounds each. The breed has been known for nearly a century, but it is only in more recent years that it has assumed any prominence, or occupied a place in public favor. It appears that previous to the Civil War, the largest and finest flocks of Hampshires were found in the
Southern States, but were practically exterminated during the four years' hostilities. Within the past two decades, however, the South and Southwest have been again importing, and they are said to surpass the Southdown in acclimating and adaptability to our peculiar conditions.

OXFORDSHIRE.

This valuable breed of sheep is said to have been produced by crossing the Southdown ewe, and in several instances, the Hampshire ewe, with a Cotswold ram. By putting the crosses together, and by constant attention and judicious selection, a breed of sheep has been obtained which combines uniformity of character and hardiness of constitution, with large frames, aptitude to fatten, and mutton of superior quality.

The first importation was made into the United States by Mr. Clayton Reybold, of Delaware City, Delaware, in 1846. In 1853 William C. Rives, of Virginia, sent to that State 1 ram and 5 ewes, and a Mr. Fay introduced them into Massachusetts about the same time, obtaining them from the same flock in England as those purchased by Mr. Rives. The breed is not so widely known as yet in this country as some others, but it is being pushed rapidly forward; and we understand that a number of Oxfordshires have
found their way into the Southwest, where they are said to be doing satisfactorily.

The face and legs are dark brown, with a greyish tinge, inclining to drab, and there is a tuft of wool at the forehead, standing well cut from the head.

The staple is about from 5 to 7 inches long, and although much the same tendency to curl as the Cotswold, it is not so long, but is closer and finer. An English writer states that, "the hoggets of this breed weigh, when shorn, from 35 to 40 pounds per quarter; and that the fleece of an entire flock will average about 7 pounds."

It is not infrequent to find two-year-old fat wethers weighing from 275 to 300 pounds; and the Oxfordshire ram, "Freeland", at two years old, when imported from England by T. S. Cooper, of Coopersburg, Penn., weighed 425 pounds.

Owing to the original home of this breed, at the foot of the Cotswold Hills, they are said to stand wet or springy range better than any other breed of sheep.
The county of Gloucester, England, is the native locality of the Cotswold breed, where it has existed for a very long time, mention having been made of it in history in the early part of the 15th century. It has, however, been much improved in more recent years by the introduction, it is believed, of Leicester blood, and by selection in breeding and careful treatment. The breed has become widely known in this country, into which the first importation was probably made about 1840.

In aged sheep the flesh is coarse, but when butchered at an age not exceeding two years, the meat is of fair quality; and at that age, when well fed, should weigh from 30 to 35 pounds per quarter; mature sheep making from 275 to 300 pounds live weight. In the Cotswold, the wool product is an important item. The fleece, which is closer upon the body than the Leicester, averages from 8 to 16 pounds. The staple is long, mellow to the touch, pure white, and wavy. The breed is without horns, has white faces and legs, and with a strong tuft of wool covering the forehead which is more prominent in the male than in the female. The ewes are prolific, good mothers, and the lambs are covered with a thick, close fleece.

LEICESTER.

Ever since the time that Robert Bakewell, of Dishley Hall,
Leicestershire, England, originated the improved breed of Leicester sheep by judicious selection, it has been considered the principal breed of long-wooled sheep, in the British Isles, at least. It is essentially a refined breed, as regards form and quality; and for this reason it has been employed with great success in the improvement of other breeds.

The Leicester is said to have been introduced into Virginia and New Jersey prior to the war of Independence, and later into other States, particularly New York, where for a time it became the prevailing breed; but it has not obtained an extensive foothold in the West, and we are not aware, at present, of any breeders in the South.

The face and legs are white, and the breed is hornless. Early maturity and great aptitude to fatten are characteristics of the Leicesters, and these qualities are imparted to other breeds when the Leicester is used in crossing. The fleeces of high-class flocks average from 7 to 9 pounds. Fat two-year-old wethers will weigh from 230 to 260 pounds. The ewes are only medium nurses, and the lambs are tender. So that, although doing well in some sections, the pure Leicester cannot be looked upon as a favorite in all parts of the country.

BORDER LEICESTER.

This is a variety of Leicester sheep, bred in the South of Scotland, and in the North of England. Or, in other words, in the counties bordering the two countries; hence the name. The sheep differ in some respects from those of the midland districts of England, although both started with the same materials, and from the same common source. The difference lies chiefly in the head; that of the Border Leicester being a clearer white, the nose is more Roman, wider nostrils, and erect ears, and the carcass is longer and larger, besides some few other minor points. It is probable that the difference in climate, in the general treatment, and the diversity in the breeders' tastes, have been largely responsible for the change. In the south of Scotland, Border Leicester rams are used chiefly in crossing with Cheviot and Scotch black-faced ewes.
This breed, which has long inhabited the lowlands of Lincolnshire and other eastern counties of England, is an important one, both on account of its meat-producing properties, and the weight and quality of its fleece. Originally the Lincoln was a gaunt, raw-boned, ungainly animal. But the modern sheep, as it is known today, has resulted from the free introduction of Leicester blood, combined with improved breeding and feeding. The first introduction into the United States was made by Leonard D. Clift, of Carmel, N. Y., in 1836, since which time the breed has been distributed throughout many of the Northern and Middle States. The fleece is the longest of the long wools, showing a staple of from 9 to 12 inches in length, and which, in high-class flocks, yields an average of from 9 to 15 pounds.

The breed is hornless, the face and legs are white, and there is a tuft of wool on the forehead.

Of the foregoing improved breeds of sheep, the following have been tried at the North Louisian Experiment Station, with, how-
ever, but moderate success: American and Delane Merino, Horned Dorset, Southdown, Shropshire, and Cotswold. It may have been that the change of climate and environment have been partially responsible, as the animals were all imported from further north, but the most potent factor for evil we believe to have been, especially in the case of the lambs, intestinal parasitic diseases, more particularly "nodular disease of the intestines," and "stomach-worm disease" (verminous gastritis), located in the abomasum or fourth compartment of the stomach, of which more is given later in this bulletin. It may be mentioned, however, that one of these diseases, if not both, was most probably introduced on to the Station pastures through the medium of imported animals, as several of those that subsequently died, shortly after being imported, were extensively affected with nodular disease. Of the breeds tried the Merino has done best, followed by the Southdown.

After a somewhat careful consideration of the possibilities of success with improved sheep husbandry in Louisiana, taking into account the imperfect state of the knowledge that generally exists concerning selection, breeding, feeding, and general care and management of this domestic animal, and the parasitic infestation of our pasture and grazing lands, the question has arisen in our mind: Is it really worth while for our farmers and stock raisers, from an economic point of view, introducing, under such conditions, the improved breeds of sheep? If they are to receive no better treatment than that at present afforded our flocks of natives, we say, emphatically no! But, on the other hand, if we are prepared to make the change, from the lack of system, at present widely prevailing, to one which will, as nearly as possible, meet their requirements in order to get the best results, and make the investment a profitable one, then we just as emphatically say, yes!

We give it as our opinion, however, that the attempt to raise improved sheep upon our range, and other permanent pasture lands, previously, and for a length of time, grazed over by our native sheep, will most probably result in disaster. There is scarcely a flock of sheep of any size in the State that is free from nodular disease of the intestines; and where these have been confined for a year or two, or more, the pasture becomes infected and re-infected through the parasites being extruded with the bowel discharges. And the sheep, in grazing closely, which is their natural method of feeding, picking up the parasite (a very minute worm) in probably some immature stage, and becoming infested for the first, or perhaps several successive times. With the life-
cycle of the parasite kept up in this way, from the sheep to the pasture, and from the pasture to the sheep, it can be readily conceived how permanent grazing-ground may be permanently infected, and be able to infect fresh animals, or re-infect those that had previously occupied it.

In a general way, the foregoing may apply in the case of the majority, if not all, of the intestinal parasites of sheep.

There is a familiar theory, which seems to have crystalized into a firm belief with our sheep owners, that it is impossible to raise, successfully, a large flock of sheep; but that a small number, say twenty to fifty, do very well and remain comparatively healthy.

The theory seems to be well founded, as it is based upon actual experience; but no adequate reason, so far as we have ever heard, has been thought of, or, at least, stated, to account for the circumstance. Our own opinion in the matter, which we give for what it is worth, and which we think will bear the thoughtful consideration of our sheep men, is, that large flocks usually occupy, and are confined to, the infected range or pasture; while the small "bunch" is not so confined, but is given carte blanche to roam over different parts of the farm, wherever inclination directs, and, consequently, escapes infection to a very large extent. Or, in other words, its members are very little, if at all, exposed on a permanently-infected area.

Intestinal parasites (worms), of various kinds, are the chief enemies of the flockmaster, and when once grazing-lands become infected with these worms, or their eggs, or other immature stages, they become a great menace until they are broken up, cultivated, and properly drained, which all experienced sheep men know, often from sad experience. It is our old, undrained pasturage, or range lands that become so dangerous when once occupied by sheep affected with internal parasitic diseases. Hence, we believe, that if we are to make a lasting success with the raising of improved sheep, the industry will have to be undertaken, for the present at least, on the farm, rather than upon the range, so that the flock may be moved, frequently, owing to the necessity for cultivation, from one feeding ground to another; and that suitable crops may be raised, in order that the sheep may be prepared for the market in the shortest possible time, and in the best possible condition.

A point worthy of insertion here, is the fact that we are apt to lose sight of the value of the droppings and liquid manure from sheep upon our farm lands. These little animals are said to be the best "manure-distributers" of all farm stock; and when the
improved breeds, which possess a much greater aptitude to fatten than the native or scrub, are intelligently used as factories to convert the cheaper food-products of the farm into a finished product, in the form of high-quality and high-priced mutton, the land receives the benefit of the rich fertilizing material for subsequent plant food, as a free gift, so to speak, and this in addition to the profit the owner obtains in the enhanced value of the food stuffs after their having assumed the form of a finished article in the first-class mutton—or wool—sheep.

After all, it may be said, that the domestic farm animals are but means to an end. In the case of the meat-producers, they are the means by which the farmer can realize an increase in value for the cheaper "raw material" (food crops) of the farm.

Should we decide, then, to improve the quality of our sheep, either by grading up from those we already have, or discarding the native altogether, and introducing the improved breeds direct, the question comes up as to how and where we are going to be able to secure sound animals? In the first place, the large majority of our natives are affected with nodular disease, and, as this ailment is widely distributed all over the country, it is difficult to be certain of absolute freedom from it in animals introduced from almost any section of the United States. This difficulty is certainly a very serious one in the way of attempted improvement in the quality of our flocks, and which would be doubly grave, were it not for the fact, as proved by experiment, that it is possible to raise lambs free from this disease, even although they may be the progeny of diseased mothers. Such being the case, the trouble as to the uncertainty of being able to obtain sound lambs and sheep, is, in consequence, greatly obviated. In the experiment above referred to, and which will be mentioned in detail later, which was to test the question of lambs becoming infected with nodular disease after grazing on infected pastures, two lambs (from diseased mothers) that had been born and kept in a shed, or large loose-box, with clean floors covered with saw-dust, and where there was no possibility of infection, were placed on a small grass-lot (about one-quarter of an acre in extent) on which three infected sheep had pastured for the previous 13 months. After a period of 3½ months, both lambs died, from stomach-worm-disease however, but nodules were found on the intestines of each. Two other lambs, born about the same time, and under precisely similar conditions, but which were kept away from the infected lot, and not exposed to infection, remained perfectly healthy; and when butch-
ered, about 10 weeks after the death of the other lambs, showed no signs of nodular disease whatever, although in their case also, the mothers were affected with the disease.

Although we expect to further continue experiments along this line, the above results go a good way to show that a sound flock of sheep may be raised from one infected with nodular disease, provided the necessary precautions are taken to avoid contamination. But there could be no possible advantage, or profit, in raising a sound flock, and then turning it onto an unsound pasture to become infected, which would unquestionably be the result, in the case of the majority of our sheep ranges or pastures in the condition in which they are at the present time.

The object of the prospective sheep raiser in the State should be to obtain sheep free from the disease, and have them remain so, even if he has to raise them from diseased mothers. But he could not maintain absolute freedom, unless he possessed infection-free feeding-grounds to place them upon; and for such, we believe, he will have to depend, either on range that has never, or for a considerable period of time, been occupied by sheep; or he must make preparation for them on the cultivable areas of the farm, with suitable pasture, root, rape, or other crops requiring cultivation, rotation, etc., which latter are inimical to the life and development of intestinal parasites in general.

Besides clean grass and leguminous pasturage, a number of suitable crops for sheep can be raised in the State in great abundance. Root crops are especially valuable. Turnips, ruta-bagas, kohl-rabi, etc., grow with great luxuriance, and can either be eaten from off the land, by hurdling the sheep on them, or gathered and fed in some other way that may be more convenient. Dwarf Essex rape is a magnificent food crop for sheep, and which is usually pastured, a portable fence made of hurdles being used, so that the flock can be moved from one part of the field or patch to another until the whole is consumed. Excellent pasture crops can also be obtained from the small grains, such as oats, barley, wheat or rye, and which may be fed off and turned into mutton in a similar manner to the rape.

Apart from what might be termed green or succulent crops, which are so valuable in sheep-husbandry connected with general farming, we have the different grain crops grown, which may be fed, as such, when required.

One great benefit derived from pasturing sheep on crops such as
roots, rape, green oats, etc., on the land, is, that apart from their special excellence for the growing and fattening of sheep, the soil is enriched by the manure, both solid and liquid, which is uniformly distributed all over by the flock.

Another desideratum is, that the majority of the crops mentioned can be made to occupy the land at a time when, under ordinary conditions, it would be lying idle, after the staple crops have been harvested.

As to variety, quality and quantity of suitable food crops for sheep that can be grown in the State, there is practically no limit. All of those enumerated have been and are being raised and utilized successfully on the State Experiment Station, and from where specific information regarding them may be obtained at any time.

There are at least two ways by which improvement may be obtained in the quality of the sheep in the State, viz.: By the direct introduction of animals (male and female) of the improved breeds; or to import males only, and grade up by crossing them on selected native ewes. Perhaps the latter method would, in most instances, be the more practical, and safer, in the present state of our knowledge regarding the industry, and more especially as the existing flocks of natives could be utilized as a basis for the operation.

Owing to the degeneracy, so to speak, into which our natives have fallen in many respects, it may appear somewhat of a problem to know just how to start on the “up-grade.” The North Louisiana Experiment Station has done some work along this line, and the following method of crossing and grading seems to have yielded a very satisfactory product: A typical native or scrub ewe, with all the characteristic length of leg, and woollessness of the thighs, forearms, belly, etc., was crossed with a Delaine Merino ram with the object of producing a lamb that would be better clothed with wool. The female product of this cross was then served by a pure Southdown ram for the purpose of transmitting to the offspring some of the chief characteristics of the Southdown, which is, of course, a typical mutton sheep; and, as we have just stated, the result proved very satisfactory.

In the experience of the Station, the Merinos have proved themselves hardier and less susceptible to disease than any of the other breeds it has tried. With this hardiness of the Merino, combined with the developed “toughness” and resistance of the native, and the general good qualities of the Southdown, the product which might be still further improved, should be a very desirable animal for our climate, and an immense improvement upon the scrubs of
the English and Spanish breeds, the remains of the legacy which was left to us by the early pioneer settlers.

SOME OF OUR COMMONER LOCAL INTERNAL PARASITIC DISEASES OF SHEEP.

In treating the internal parasitic diseases of sheep, we have considered it better to allude to those only that have come under our personal observation as producing losses of a more or less serious character in the State, rather than to write a general treatise on this class of diseases, which we think is not called for under the present circumstances.

PARASITIC NASAL CATARRH.

This condition is also known as "grub-in-the-head," and is the result of an irritation and inflammation of the mucous-membrane of the nasal passages and sinuses, or cavities, of the head, produced by the grub, worm, or larval stage of a fly known as the "Oestrus Ovis," the sheep bot- or gad-fly, known all over the world wherever sheep are to be found.

The number of the grubs found in the head varies widely, as seen by different observers. This is given as usually from two to fifteen, but from sixty to eighty have been discovered in very rare instances. The writer has extracted forty-two larvae, of different sizes, from the head of a single sheep at this Station during the month of April, and we are inclined to the opinion that even this large number is not the maximum that may be reached during the height of the "fly-season" in this section.

Few writers on the subject seem to credit this parasitic invasion of the heads of sheep with any very serious effect upon their general health and condition, although the grubs may be present in considerable numbers. Where two or three are only lodged, one would hardly look for any marked disturbance, beyond a more or less aggravated discharge from the nasal chambers, and even this may go unobserved, but when we find such gross invasion by these para-
sites as we have personally found to be the case, we can not but believe that the intense amount of irritation of the delicate mucous-membrane, and its results, must have a pronounced evil effect upon the general health, vigor and condition of the animal. In fact, in what might be termed extreme cases, and we think we are justified in placing ours in that category, Neumann states that: "In severe cases there is a difficulty of breathing, the first respiratory passages being obstructed by the larvae or the inflammation of the mucous-membrane. The eyes are red and watery. The disease may be still further complicated. The sick lose appetite and rapidly grow poor; they grate their teeth; a frothy saliva runs from the mouth; their eyes roll in the sockets; convulsions arise, and finally death ensues, sometimes within eight or ten days after the appearance of the first symptoms."

The fly, which is the mature stage of this parasite, resembles in appearance an overgrown house-fly, and belongs to the same family as the horse bot- or nit-fly, with which all stockowners are familiar, although it is smaller. It is so quick in its movements, when on the wing, as to be almost invisible; darting with lightning rapidity toward the nose of the sheep, and depositing small larvae (not eggs) within the nostrils from where they crawl up the nasal cavities by means of hooklets on their anterior extremity and small spines on the body, into the sinuses of the head, sometimes being found as far up as the horn-cavities in horned sheep. But they do not, as is sometimes thought, enter the brain.

The mature larva (grub) is about three-quarters of an inch in length, the body is dark in color and striped with black bands, and the spines also have turned black. The larvae are said to remain about eight to ten months in the sinuses of the head. Having reached maturity, the grub detaches itself from the mucous-membrane, passes from the sinuses into the nose, and is expelled therefrom by the violent sneezing and snorting it excites in its host. Having reached the ground, it burrows into it, and in about twenty-four hours it assumes the chrysalis or pupa stage, and remains in this condition from one to two months, depending upon conditions of the weather. On arriving at maturity within the chrysalis, the fly pushes up the upper end of its case and emerges; and when the body and wings have hardened by contact with the atmosphere, it darts off with wonderful swiftness, the remaining months of the year being occupied in the process of reproduction. The male insect does not attack sheep, and seems to exist simply for reproductive purposes.
SYMPTOMS IN SHEEP.

Every flockmaster must be familiar with the alarm and excitement produced in a flock of sheep by the presence of the sheep bot-fly, such as running about, shaking their heads, stamping with their forefeet, keeping their noses close to the ground, huddling together along fences or under shade trees or buildings, burying their noses in dusty places, etc., all of which may be seen during the prevalence of the fly. The characteristic chronic nasal catarrh (running at the nose), as well as other symptoms previously mentioned, are to be seen later, and result from the irritation and inflammation produced by the grubs located in the upper part of the nostrils and in the sinuses or cavities between some of the bones of the head. It is stated by Dr. Cooper Curtice, that it would be probably correct to say that the fly may appear at any time when the temperature is not too low, but that they are more abundant in early and midsummer.

In the early morning and late evening sheep seem to enjoy freedom from attack by this pest, as it does its work during the heat of the day.

In again reverting to the grub, it should be stated that many of them in the mature larval stage in some of the sinuses are so large as to be unable to pass back into the nostrils, owing to the small size of the aperture through which they originally passed up, and are in consequence retained there, finally dying and undergoing degeneration.

The treatment is of three kinds, viz.: Preventive, medicinal, and surgical, but as the two latter lack in practicability, so far as the great majority of our sheep owners are concerned, we will confine ourselves specially to preventive measures. One of these is to smear the nose, and up the front of the face, with a mixture of equal parts of tar and grease or fish-oil, which should be applied directly with a brush. The following salve or ointment is also recommended by Powers for this purpose: Beeswax, one pound; linseed oil, one pint; carbolic acid, four ounces. Melt the wax and oil together, adding two ounces of common rosin to give body, then, as it is cooling, stir in the carbolic acid. This is prescribed to be rubbed over the face and nose two or three times during July and August, or, we might add, whenever the fly is prevalent.

Still another method is to keep salt for sheep in holes made in a log with a two-inch augur, and to smear round the edges of the holes with mixtures such as already suggested, which however, should be frequently replenished to prevent drying or becoming ab-
sorbed. The log should be protected from the weather. The idea here is, that when the sheep go for their salt, they will at the same time smear their noses themselves. The object of these methods is to prevent the fly attacking the sheep's nose. Professor Neumann, an eminent European authority whom we have already referred to, gives the following advice where large numbers of animals are affected, except in the case of the breeders of valuable sheep: "At all times, if the number of animals affected is considerable, the malady should be left to follow its course, and those which present the gravest symptoms should be sent to the shambles." This is perhaps the best advice that could be given under such conditions, and we believe that, so far as allowing the malady to run its course is concerned, it is the method that is at present in vogue with us. Still we think that if some of the above-quoted measures were adopted, it would have some influence in the right direction. To reduce the numbers of this gadfly, all larvae or grubs found should be destroyed to prevent their development into flies. And in this connection it might be well to draw attention to the fact that at least one potent source of the increase of these flies is to be found in our butcher-pens. The heads of butchered sheep are not utilized in this section, as they are in many parts of the world, but are simply thrown away as offal. Many of the grubs invading these heads crawl out on to the ground, and those at, or nearing maturity, pupating, must, in quite a number of instances, reach the fully developed fly stage. We believe if such places where sheep are slaughtered were looked after in a proper manner, and the heads of butchered sheep carefully disposed of to prevent the escape of grubs from them, it would effect, quite considerably, a reduction in the numbers of these sheep gadflies.

TAPE-WORM DISEASE.

We are not aware that tape-worms are very prevalent among our flocks in the State, or, at least, our attention has not been directed to them as a source of loss in sheep. We have, however, observed the variety known, technically, as the "taenia expansa" or broad tape-worm, one of the most frequently met with in this country, in two lambs that died on the Experiment Station; and in order to meet conditions, should this parasite be more widely distributed than at present presumed, we give the following information regarding it. The two lambs were those used to test the transmission
of infection of nodular disease from infected sheep to pasture, and from pasture to other animals. On examination, post-mortem, a tape-worm was found in the small intestine of each of the lambs, as well as nodules, which will be referred to in the proper place. We believe that the source of the tape-worm infection, as well as that of stomach worms (given in greater detail in the next article), was an unhealthy 6-months-old lamb that had been brought to the veterinary department for examination, but which was turned on to the pasture lot with the other nodular-affected sheep.

Adult specimens of the taenia expansa measure from four to five yards although some European observers refer to them as sometimes attaining the great length of one hundred feet. According to Dr. Cooper Curtice, the life history seems to be a comparatively simple affair, viz.: "The embryos pass from sheep to sheep and develop into adults, which reproduce young for infection of other animals. Whatever changes the embryos may pass through outside of the sheep, can have little to do with the case so far as a knowledge of prevention of infection goes, for but very few of the conditions under which these sheep were kept (sheep with which Dr. Curtice was making investigations) can be improved by the flockmaster."

The treatment for tape-worm is both preventive and curative. The first is that which might be suggested for the general prevention of parasites, and the observance of those measures which promote good health in the flock. These are, as recommended by the same authority: "Good, pure water; put lambs on to new pastures if possible; pastures should not be overstocked; feed some grain; salt should be placed where sheep can partake of it daily; feed hay from racks, and grains, salt, and water, from troughs." This, as may be inferred, is to prevent the necessity for lambs having to graze over infected pastures as much as it is possible.

Quite a number of medicinal agents are used in the treatment of tape-worm disease, or, in other words, to get rid of the worms from the intestines of their host. Whichever may be adopted, the sheep should be prepared by being kept free from food and water for a period of at least twelve hours, so as to permit of the more direct action of the vermifuge. The following are one or two prescriptions recommended:

Kamala, 2 to 3 drachms.

Mix thoroughly in three to four ounces of linseed gruel. This is the dose for adult sheep. Lambs take from one-half to two drachms of Kamala, according to age.
Another: Take of the Ethereal Extract of Male Fern, 1 drachm; Castor oil, four ounces. Mix and give as one dose to grown sheep; and from one-quarter to three-quarters of the above quantity to lambs.

Another: Take of Powdered Areca Nut, one-half to one drachm; Oil of Male Fern, ten to twenty drops. Mix and give in molasses and water.

The administration of these remedies should be slow in order to better insure their reaching the intestines.

All prescriptions for the treatment of tape-worm that are not combined with a purgative, should be followed, the next day, by some medicine to clear the bowels, and for this purpose the following is useful:

Take of Epsom salts, 2 ounces; warm water, 1 pint. To be given in one drench.

For use as a restorative, and which may also act as a preventive, the following is recommended:

Take of common salt, 2 pounds; Epsom salts, 1 pound; powdered copperas, one-half pound; powdered Gentian, one-half pound.

The above to be mixed and fed with ground feed or fodder, sufficient for 75 to 100 sheep.

STOMACH-WORM DISEASE.

Stomach-worm disease is caused by a minute round worm inhabiting the abomasum, or fourth compartment of the stomach of the sheep, and is known technically as the “Strongylus contortus”, and popularly, as the twisted stomach worm. This parasite is from one-half an inch to an inch and one-half in length, thread-like, with its body terminating in a pointed tail. When seen in the stomach of the sheep, after death, it may be found in immense numbers, all tangled together in a wriggling mass of pinkish-brown color, the latter being due to the blood in their bodies abstracted from the wall of the stomach of their host. The writer has observed them in such great quantities as to obscure the normal color of the mucous-membrane of the stomach. Anyone not accustomed to their appearance might easily overlook their presence on account of their minuteness and matted condition.

Adult sheep are not so much affected as lambs and yearlings, in which they frequently cause extensive losses to flockmasters. Their
occurrence is widespread, being found in all countries where sheep are kept.

We are of the opinion that, although nodular disease of the intestines may cause considerable annual loss in lambs throughout the State, stomach-worm disease is responsible for a large percentage of the mortality. For several years the North Louisiana Experiment Station has suffered severely through the death of a considerable portion of its lamb crop, which was attributed almost solely to nodular disease, until a closer examination, later, revealed large numbers of twisted stomach worms (a few nodules being present) which it is thought were brought on to the station by pure-bred lambs imported, from time to time, from other States for breeding purposes. In one of the lambs that died on the station at Baton Rouge, and which was exposed to nodular infection, stomach worms were found in great abundance; and although only one lamb was examined for these parasites, we are of the opinion that both lambs died from their effects, as the nodules found were but few and not in sufficient numbers to cause death. We believe the source of infection in this case was the sickly lamb, already referred to, as being brought to the station for examination. A post-mortem examination of this animal showed numbers of nodules along the course of the intestines; but, as our attention was specially directed, at the time, to finding nodular disease, we, unfortunately, did not investigate for stomach worms. However, as this animal had all the evidences of acute parasitism, and being the only lamb brought on to the place, and besides, never having had sheep on the lot, or, at least, for the past thirteen years, to our own personal knowledge, it seems feasible to presume that suspicion should rest very strongly with this lamb as being guilty of introducing these worms.

It seems to us that a very important lesson might be learned by our sheep men from the foregoing experiences. Whenever they have to procure sheep, and more particularly, lambs, for the improvement of their flocks, they should exert the greatest care in knowing that they are free from these worms, or should take the precaution to dose them before placing them with their other sheep, with suitable remedies (vermifuge medicine), some of which will be found at the latter part of this article.

The symptoms of stomach-worm disease are not very characteristic, and are not easy to distinguish from those seen in other intestinal parasitic diseases. The most accurate diagnosis is made on post-mortem, either in a lamb that has succumbed, or on one that has to be sacrificed for examination. But the following may
be observed during life: Dullness, loss of, or depraved appetite; a tendency to remain apart from the rest of the flock; increased thirst; sometimes diarrhoea; bagging of the skin underneath the lower jaw (dropsical effusion); emaciation. In acute cases there may be signs of abdominal pain; grinding of the teeth; the belly may become enlarged and tense; the animals bleat considerably. Some may die suddenly without exhibiting any evidences of the disease, but the majority succumb after lingering around for a week or two. If dark-colored diarrhoeal discharge takes place, it usually ends fatally.

The life-history of this parasite, according to some of the best authorities, is probably as follows: The eggs fall to the ground from the infected animals; they are taken up by other sheep along with their feed, and they then arrive at the abomasum or fourth compartment of the stomach and develop there. It is claimed by some observers that the probable source of infection is through the medium of the water supply. Water is no doubt one of the more common media of transmission, and should warn sheepowners against the danger of such contamination with the excrements of sheep infested with these worms. But this cannot be the only method or source of infection, because, in the case of the lambs that died at this station, the drinking water was supplied in a large metal tub, which was kept frequently replenished, and no stationary pools of water were at any time accessible to the sheep.

As in the case of other parasitic diseases of the digestive tract, the treatment of stomach-worm disease is both preventive and curative. As previously suggested, sheep breeders and raisers should strictly guard against the introduction into their flocks of animals from other flocks before satisfying themselves of their freedom from these parasites, or taking the precaution to treat the newly-imported sheep with medicine that will destroy the worms, previous to their being put with the flock. Try to keep lambs off infected pastures. It is recommended that they be turned into the corn-fields to feed off the lower blades, and the grass, and thereby escape contamination. Yarding and giving dry feed is also suggested. It is evident, that to obtain the best results, the animals must be changed off the contaminated fields, for a time, at least, on to some other feeding ground, as a part of the treatment, besides administering medicines to destroy the worms in the sheep.

A good many remedies have been prescribed for the successful treatment of stomach worms, of which the following are a few:

Dr. A. W. Bitting, of the Indiana Experiment Station, recom
mends one part of coal-tar-creosote, well mixed with one hundred parts of water. Two ounces of the mixture to be given each lamb by using a 2-ounce hard rubber syringe, having a short piece of soft rubber tubing on the end. One to three treatments, given a few days apart, may be necessary.

Another is to add one part of spirits of turpentine to sixteen parts of milk, and give from two to four ounces of the mixture to each animal, according to age.

The following is from Finlay Dun's standard work, "Veterinary Medicines": Take of common salt, three pounds; powdered ginger, one-half pound; powdered saltpeter, one-half pound. Dissolve in three gallons of warm water, and when nearly cold, add 24 ounces of spirits of turpentine. The dose of the mixture is two ounces for lambs between four and six months old. The entire quantity is sufficient for 160 lambs.

Three to five grains of Picrate of Potash, dissolved in water, has been recommended for lambs by Zurn.

Gasoline has been used with a good deal of success, both in France and in this country. One tablespoonful mixed with milk, linseed tea, sweet oil, meal gruel, or other simple vehicle, is the dose for a lamb weighing 75 pounds. For adult sheep, 2 to 3 tablespoonfuls of gasoline are used.

It might be well to state here, that care should be taken, in drenching sheep or lambs, to prevent asphyxiating them. The better method is to place them upon their haunches. elevate the head just sufficient to assist the fluid to gravitate toward the back of the mouth, and give the medicine slowly and in small quantities at a time, to prevent choking. Should the patient cough, stop the administration of the medicine, and release the head at once.

NODULAR DISEASE OF THE INTESTINES.

It does not seem necessary to introduce this disease by entering into a lengthy detailed history of its early occurrence, identification, prevalence, etc. Suffice it to say that there is hardly a State in the Union that can claim freedom from it among its flocks. For some time it was mistaken for tuberculosis, the nodules or tumors on the intestines resembling somewhat the tubercles of consumption, but later investigation revealed the presence of a very minute round worm as the true cause.

The disease gets its name from the nodulated condition of the intestines, they being, in advanced cases, thickly studded with no-
dular enlargements all along their course, as far back as the rectum or last portion of the bowel. Everyone who has butchered sheep must be familiar with the appearance, although perhaps ignorant of the cause of this condition, known popularly in some localities by the term, "knotty-guts".

In the adult stage, the worm or parasite (Oesophagostoma Columbianum) is about one-half an inch in length, and may be found located in the intestines, and more particularly, the large bowel. The immature stages, or forms, vary in length from 1-100 to 1-6 of an inch, depending upon age and stage of development. These are found encysted in the nodules. The writer has dissected quite a number of the larger older tumors without finding the parasite in them, and from which we would infer that they had escaped into the intestine. The life history of this minute worm, so far as seems to be known from the more recent investigations, is as follows: The mature female lays her eggs in the intestine. The eggs hatch in a short time, and the embryos, or minute immature worms, pass, in some manner, through the mucous, or internal lining of the bowel, and become encysted or embedded there. And the irritation produced by the worm seems to give rise to the nodules or tumors, which can be seen, of various sizes, projecting from the intestine, sometimes along its entire length.
The tumor consists of a cheesy material, often greenish in color, which, on breaking its outer covering, can be squeezed out. It is thought by Dr. Curtice that the embryos are the chief cause of the trouble, and that the adult worms produce but very little, as the latter are comparatively few as compared with the number of tumors. Some of the adult parasites, and probably some of the eggs, pass out from the intestines with the manure, and in this way pastures and other feeding quarters are infected; and in turn, shallow and sluggish watering places into which they drain. There is, however, a stage in the life cycle of the worm that seems to be still undetermined. That is, from the time it leaves the bowels with the manure until it is again found in the tumors on the intestines.

The symptoms of nodular disease are not very characteristic during life. In fact, there must be thousands of fat sheep slaughtered annually in the abattoirs of the country affected with this ailment, which exhibit no special indications previous to being killed. But in the more advanced stages of the disease, the symptoms resemble those seen in other parasitic troubles, such as general debility, and in the most severe cases rapid emaciation, and excessive diarrhoea. A positive diagnosis can only be made by post-mortem examination and finding the characteristic nodules on the intestines. The cause of death in acute cases is evidently the interference caused by the tumors to the process of absorption. Or, in other words, the animal is deprived of proper nutrition on account of the function of the intestinal walls being interfered with by the tumors, and the process of absorption of nutrient material thereby lessened. The extent of the derangement may be said to be in direct ratio to the number of tumors present.

The treatment so far suggested is chiefly preventive, although we believe the best results would be obtained from a combination of both preventive and curative, when handling an infected flock. The chief drawback to the desired effects of medicinal treatment is the embedded or encysted position of the parasites in the tumors which seem to be beyond the reach of medicines. Still, as adult worms are found free in the bowels, vermifuge medicines would necessarily have some effect upon those in this situation. The gasoline treatment described for stomach worms, under stomach-worm disease, has been recommended. A weak solution of creol in seems to have given favorable results in the hands of Dr. M. Jacob, of the Tennessee Experiment Station, a report of which he gave in a paper read before the United States Association of Experi-
ment Station Veterinarians, at Atlantic City, N. J., in September, 1901. We quote from his paper the following: "Sheep had been dying at the rate of four or five a week. They had been put in a new field about six weeks previously, but still continued to die until after they had received, daily, about 20 minims of crude creolin per head. This was prepared in the form of a drench by dissolving 5 ounces of creolin in one gallon of water, and giving each sheep about one ounce a day for ten days. This treatment seemed to give pretty fair results, for during the next two or three months the death rate was very markedly decreased." Dr. Jacob thinks the treatment ought to be continued for at least one month. The individual treatment of sheep, where there are large numbers of them, is an undertaking which but few of our sheep owners in the State would attempt, except, perhaps, in the case of the animals being valuable pure-breds. Dr. Cooper Curtice also states, however, "that in case medicinal remedies are tried, each animal must be dosed".

Those who are at all familiar with intestinal parasitic diseases are aware that medicinal treatment alone will not yield satisfactory results, but that other measures, outside of the animal, must likewise be adopted. For, to attain our object, we must not only endeavor to destroy the parasites in the animal, but we must also treat the infected pastures to destroy or render innocuous the parasites that may be on their surface, and capable of infecting animals (sheep in this case) grazing over them. A combination of both, then, is necessary for the most satisfactory results. Curtice remarks, "that the same care in changing pastures, in providing good drinking water and a plentiful supply of salt, should be observed in this disease as for other parasites. Judicious fall and winter marketing of infected sheep will also tend to lessen the chances of infection. If pastures are known to be permanently infected, then they should be turned over to other stock for a year or two before being again grazed on by sheep. When it is practical, on the smaller farms, the sheep lots should be plowed, and either planted or left fallow. The object of change of pasture and of plowing is nearly the same; in the one case to wait until the parasites have died out; in the other, to bury them beneath several inches of soil, from which the sheep owner may rest assured they will not emerge."
EXPERIMENT.

In order to make a practical test of the question, for our own satisfaction, as to whether a pasture would become infected after being occupied by sheep affected with nodular disease, and the same pasture afterwards capable of transmitting the disease to healthy lambs, an experiment was commenced at the State Experiment Station on April 10, 1901, by confining three sheep from an infected flock on a small pasture lot, of about one-quarter of an acre in extent, which had not had sheep on it for at least thirteen years.

On February 2, 1902, one of these sheep died, after presenting the usual symptoms of internal verminous disease, such as general debility, emaciation, anaemia, etc., accompanied by loose bowels for two or three weeks previous. An autopsy revealed great numbers of nodules along the course of the intestines.

In order to obtain lambs free from nodular disease to place upon the pasture lot (after the infected sheep had occupied it from April 10, 1901, till about the beginning of May, 1902), several pregnant ewes were purchased by the station and placed in a shed with floor kept clean and sprinkled over with sawdust. Grain was fed to them out of troughs, and green oats, or other soiling crop, out of racks, and they were watered from low-sided tubs or buckets. These ewes were suspected of having nodular disease, and which proved to be the case, later, when autopsies were made.

After the lambs were born (between March 25th and April 19th, 1902) the following method was adopted in raising them until they were able to be placed on the lot with the infected sheep: A long shed was used, which was divided off into three compartments, with small gates between each. When separated, the ewes occupied one of the end compartments, and the lambs the other, leaving an empty one between. During the suckling periods the bars were lowered, and mothers and lambs allowed to come together in the middle compartment. As soon as nursing was over they were again separated into their respective compartments, and in this way were kept from one another, except during the suckling periods, to avoid contamination as much as it was possible.

Four lambs were saved out of half a dozen, two dying from the effects of cotton seed meal, which was an ingredient of a grain mixture fed when they were thought to be old enough to eat a little concentrated food.

On May 3rd and 5th a lamb, with its mother, was placed on the infected lot.
On July 24th the first lamb died. Post-mortem revealed a number of small nodules on the large intestine, and a tape-worm (*taenia expansa*) in the small bowel.

On August 22nd the second lamb died, and a number of small nodules were found on the large bowel; a tape-worm in the small bowel; and great numbers of twisted stomach worms in the fourth compartment of the stomach.

The autopsy on the first lamb that died was made by one of the college students during the temporary absence of the writer on State Farmers' Institutes, and stomach worms were not examined for. But it is our opinion that these worms were the cause of death in each case. Still, that did not vitiate the results of the test so far as nodular infection was concerned.

It should be stated, that, although we commenced with only three infected sheep, we had as many as eight infected animals on the small lot during the time the two lambs were on it.

A as a control experiment, the other two lambs, which were born and raised under similar conditions to the first two mentioned, were kept in a large clean box stall, were fed a little grain and green stuff (after they were weaned), and were afterwards staked out during the day on different parts of the horticultural garden, close by, but away from any opportunity of obtaining nodular infection. These two lambs remained in a healthy condition and continued to thrive, weighing, together, 108 1-2 pounds, gross, when they were butchered on November 1st, 1902.

On post-mortem examination their intestines were absolutely free from nodules.

The results, so far as they have gone, seem to point to at least four facts, viz.: First, that when sheep affected with nodular disease of the intestines are placed upon a previously sound pasture, they will infect it with the parasites of that disease. Second, that when sound lambs are permitted to graze over an infected pasture, they will contract the disease. Third, that when sound lambs are not given access to an infected pasture, they will remain free from nodular disease. And, fourth, that sound lambs can be raised from infected mothers, and will remain sound, provided the necessary precautions are taken to prevent contamination.

On October 25th, the infected lot was plowed up, and on November 1st it was sown to oats, which is the beginning of the second part of the experiment. Lambs free from nodular disease will be raised during the forthcoming lambing season, under methods similar to those adopted in the first instance. After the oat crop
has been harvested, and the lot again in a favorable condition to be pastured, sound lambs will be placed upon it, to test the question of infection after plowing under the surface, and occupying the land with a crop. Or, in other words, to test the effect of cultivation upon the eradication of infection, and which will be reported later, when results have been obtained.

In order to suggest a practical method by which sound lambs may be obtained from infected mothers, we append the following diagram.

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Dog-proof Fence.

Run for Lambs.

Ditch for Drainage.

Run for Ewes.

Ground Plan.

Dog-proof Fence.

Dog-proof Fence.

Dog-proof Fence.

Dog-proof Fence.

Dog-proof Fence.
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First of all a piece of land should be chosen not previously occupied by sheep, on which to erect the shed and runs. The shed should be divided into three compartments, the ewes occupying one end and the lambs the other, the middle one being kept for a suckling pen, as previously described. The floor of the compartments should be such that it can be easily cleansed and kept free of accumulated manure, and any material that would harbor the parasites. Two runs should be constructed at right angles to the shed, one connected with the ewes' compartment, the other with the lambs', while a space should remain between the runs, sufficiently wide to prevent contamination from the ewes to the lambs. Each run should be protected with dog-proof fencing, and both should be thoroughly drained, with the object, first, of preventing infection (the parasites) being washed from the ewes' run to the lambs'; and second, of keeping both dry. The size of the construction would have to be determined, of course, by its requirements.

After raising a crop of sound lambs each year, by this, or other suitable method, the diseased ewes could be gradually disposed of by marketing, and the infection lessened in this way from time to time. And, if the lambs, after weaning, were placed upon sound pasture, or other provision made for them, it need not be long before a sound flock might be raised from one badly affected with nodular disease.

It might be well to add, that, although the flesh of sheep affected with nodular disease can scarcely be as nutritious as that of perfectly sound animals, it is not considered to be injurious to the health of the consumer, as the diseased parts are confined to the alimentary tract only, and chiefly to the intestines. From an economic point of view, however, this disease is quite costly, not only from the annual loss in lambs and sheep it occasions, which must be considerable, but to the injury to the intestines, which renders them almost worthless for use as "sausage-casings".