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Texas or Tick Fever

BY

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TICK OR TEXAS FEVER.

BY

C. A. CARY.

HISTORY OF TICK FEVER.

Tick or Texas fever has existed in cattle for centuries in parts of Europe, Asia and Africa. It was brought to America by the Spaniard, who infested first the West Indies, South America and next Mexico. Into the United States it came by way of Florida and Mexico. Near the close of the eighteenth century, it appeared in Lancaster County, Pennsylvania, resulting from a shipment of cattle from North Carolina into that State. But the extensive and serious outbreaks of this fever first occurred in Texas and in the states and territories over which Texas cattle were trailed toward the north. This gave it the name Texas fever. Better to call it tick fever because Texas is in no way responsible for it and the cattle tick is the only real carrier of the primary cause of the fever.

In 1889 Theobald Smith, then in the Bureau of Animal Industry, discovered the intra-corpuscular parasites in the blood of cattle sick or dead from tick fever. In 1889 and 1890 Kilborne found by field tests that the cattle tick was the carrier of this micro-parasite from the sick to the healthy cattle. From 1895 to 1900, Connoway of Missouri, and Francis of Texas, inaugurated the first blood inoculation experiments that were in any degree successful. Dalrymple of Louisiana, Roberts of Mississippi, Butler of North Carolina, Nesom of South Carolina, Willoughby of Georgia, Dawson of Florida, and Cary of Alabama, successfully employed blood inoculations to produce relative immunity to tick fever in non-immune or susceptible cattle. It might be well to say that many attempts were made to produce immunity to tick fever in cattle by inoculations with blood serum, and by artifi-

cially and naturally infesting the cattle with ticks. Serum inoculations were failures. Tick infestation was relatively successful with sucking calves. But blood inoculations have been far more successful. Tabulated reports (not including 447 reported for the first time in this bulletin) give the following results made at the Southern State Experiment Station. Out of 4,750 cattle inoculated there were 361 deaths or 7.6 per cent. of the inoculated cattle died of inoculation fever and of tick fever following pasture infestation. Previous to this time, 50 to 90 of the breeding cattle brought from the North or imported into the tick infested areas, died the first summer after exposure to the tick infested pastures or ranges.

The protective blood inoculation has been a great boon to Southern breeders. But it in no way eliminates or stamps out the disease, or its cause, or the carriers of the cause. Blood inoculations produce a temporary, relative immunity in the breeding animals. But the loss of native Southern cattle is not decreased, the irritation caused by the ticks is not removed, the abstraction of blood from cattle by the ticks is not stopped, and the embargo on Southern cattle caused by the Federal quarantine line holding Southern cattle away from the free markets of the world for nine to ten months out of every year, is not revoked. In fact, ticks prevent Southern cattle from competing with non-infested cattle in growth and in quality and on the world markets.

Cause of Tick or Texas Fever.

The direct cause of this specific fever is a minute micro-parasite, *Piroplasma bigeminum.* It belongs to the lowest class of animal life and is in the same class and somewhat like the pirolplasma or micro-parasite that causes maleria in man. The micro-parasite of tick fever is carried from an infected cow to another cow, or ox or calf only by the cattle tick. The female tick sucks the blood from an infected or sick cow, or or calf, and this blood contains the micro-parasite. The female tick in some way transmits

the micro-parasite to the eggs she lays and the seed ticks from these eggs carry the micro-parasites to the cow, or or calf upon which the seed ticks feed; and about the time seed ticks molt, or shed their skin, the cow, ox or calf may have a high fever. The micro-parasites thus pass through the old female tick, the egg and the seed ticks to get from one sick cow, ox or calf to another cow, ox or calf. When the micro-parasites get into the blood of a cow, ox or calf which has not had a severe attack of tick fever, the newly infected cow, ox or calf will have fever in six to ten days. The fever comes as a result of the destruction of red blood corpuscles or cells which are broken up or disintegrated and the waste products are the coloring matter of the blood, organic substances, urea, carbon dioxide and water. The waste products must be eliminated or thrown out of the animal's body by way of the lungs, kidneys, skin and bowels. The excess of waste products in the blood and an insufficient number of red corpuscles, so disturb the natural condition of the body as to cause a fever, and changes in the liver, spleen, kidneys, lungs and bowels. In acute cases of the fever, the red coloring material of the blood is thrown off by the kidneys and then the urine is blood red in color.

THE BLOOD IN TEXAS FEVER.[1]

Texas fever is essentially a disease of the blood in which tissue are sought the only constant lesions or pathological changes. The hemoglobinuria or "red water" so commonly observed in cases of Texas fever and the blood engorged spleen are both the result of changes occurring in the blood.

When the susceptible animal is first inoculated with the parasite (Piroplasma bigeminum) by the seed tick, the average condiiton of the blood as determined in northern cattle is, *Hb. 59.75 per cent., red cells 6,152,619, white cells 5,486 with the following percentages of the

* Dimock and Thompson—Am. Vet. Rev. August, 1906.

1. This article on the blood was written by Dr. Ward Giltner, assistant Veterinarian at the A. P. I. and Experiment Station.

different varieties, lymphocytes 54.22 per cent., large mononuclear 1.47 per cent., polynuclear 30.49 per cent., eosinophiles 13.15 per cent., mast cells .59 per cent. These averages would probably hold true for southern cattle were it not for the fact that most of these cattle have suffered from the ravages of the blood parasite, so that they are probably more or less constantly anemic. A case examined by the writer in September, 1906, a few hours before the animal's death, gave the following results: An incision was made entirely through the skin near the root of the tail and no blood exuded for nearly a minute. When at length it did appear, it trickled out slowly, having the appearance of a weak aqueous solution of eosin, without clotting. Hb. (by Tallquist's method) 30 per cent., red cells 2,000,000, white cells 1,620, lymphocytes 2.6 per cent., large mononuclear 3 per cent., polynuclear 94.4 per cent.

The classic researches of Smith and Kilborne on the nature, causation and prevention of Texas fever contain an exhaustive study of the number of red cells in certain aspects of the disease, also many counts of the white cells. Nearly all the leucocyte counts show an increase that amounts to a mild or to a considerable leucocytosis, but there are a few counts where the numbers run less than normal, even as low as 1500 per cmm. No relation can be determined between the number of red and white cells or between the latter and the condition of the animal as regards the disease. It is not at all improbable that such a relation exists, no efforts seemingly having been made with this end in view. The work of the above authors gives very perplexing results, such as a leucocyte count ranging from 17,000 to 21,000 associated with a red cell count of 1½ to 5½ millions and a leucocyte count from 1,500 to 2,500 with a similar number of red cells. The number of leucocytes likewise bears no determinable relation to the stage of the disease, or conditions previous to or after the disease.

Drs. Connoway and Francis* made a very extensive test with the hematokrit in an attempt to find some relation between the temperature curve and the blood changes. The hematokrit is absolutely unreliable as a means of determining the number of red cells, since the volume of red cells will vary with the size. In certain cases where many microcytes are present the hematokrit reading will be very low while the actual number of cells might be comparatively high. It is hardly worth while to go into an extended criticism of the hematokrit even when its use is limited to volumetric analysis. They were unable to establish any very definite relation between the volume of red cells and the variations in temperature, although, of course, in a general way the volume of erythrocytes is more or less decreased during an attack of fever.

A careful review of the work of Smith and Kilborne fails to show that the blood curve in Texas fever as determined by the hematcytometer corresponds at all closely with the temperature curve. All sorts of irregularities exist in comparisons by either method. Often in the acute stages of the fever with a temperature of 105 to 106 Fah., the red cells show a reduction of only 20 per cent. while, during a later stage pending either death or recovery, a temperature of 101 degrees to 102 degrees Fah. is attended by a destruction as high as 75 per cent., or the reverse may be noted. The fact remains that there are serious and constant blood alterations and invariably a fever. An examination of about 200 temperature records (made in this department) in experimental cases of Texas Fever (i. e., cases due to blood inoculation) shows that there is no typical temperature curpe.

A study of the Piroplasma bigeminum is not without interest and profit. The growth of the parasite is undoubtedly very rapid after its entrance into the blood. It attacks the red corpuscles, destroying them so much

* Drs. Connoway and Francis—Bull. No. 48, Mo. Agri. Expt. Station.

faster than they can be regenerated that their number is reduced to as few as 1,000,000 in some fatal cases. The hemoglobin thus set free colors the blood plasma and when excreted by the kidneys imparts a port-wine color to the urine. In destroying the red blood cells the parasite sets itself free and can be found in the blood plasma in the heart muscle and kidney at post mortem. In the acute stage of the fever before the number of red blood cells has been very greatly reduced, the periphral blood and organs show great numbers of the Piroplasma within the cells, while in fatal cases when the febrile stage has passed away and the destruction of red cells has been extreme, few of the parasites will be found in the cells, but a great many free in the plasma in the kidney especially. There are many interesting features in the study of the biology of the Piroplasma and such a study has a practical bearing, but limited space prohibits dealing with it here.

The red blood corpuscle of the cow averages about six microns in diameter. The Piroplasma bigeminum as it usually occurs in the corpuscle during the fever, is a pear-shaped organism and two are usually found in a cell with their apices or "stem ends," so to speak, approximating each other. Their diameters are about 2 to 4 microns by 1.5 to 2 microns, so that they occupy about one-fourth the cubic contents of the cell. It will be readily seen that their presence alone would decrease the oxygen-carrying power of each cell invaded about 25 per cent.; but, as intimated above they are not passively located in the cells, but actively destroying the cell and setting free the hemoglobin, the oxygen-carrying element. Whether they secrete any toxic substance aside from their direct destructive action has never been determined. There are good reasons to doubt the presence of either a toxin or its natural sequel, an antitoxin.

Drs. Connaway andFrancis tried to determine "whether sterile blood serum of immune southern cattle contains any chemical substance of the nature of an antitoxin or

toxin that might be utilized pracitcally in stimulating at least a passive immunity in susceptible cattle." The results of their experiments along this line indicates that the serum contains no toxin substance since no untoward physiological effects follow its use in enormous quantities, while it evidently contains no antitoxin, since its use has no effect in lessening the severity of a subsequent or impending attack of the fever.

Dalrymple, Morgan, and Dodson of the Louisiana station were able to confirm the results and show further that the serum has no curative properties after the attack has begun. In practically all the work of this nature i. e., the transfusion of blood or blood serum, the material is secured from a so-called "immune" cow or one that has passed through an attack of the fever or at least has or has had ticks on her. Schroeder estimates that in the ordinary immune cattle there is not over one parasite to several million corpuscles. This may increase to one to fifty in fatal cases. As shown by Dr. Smith, in fatal cases the parasite is set free in the blood plasma and occurs there in many of the internal organs. Blood serum in such cases and taken from such sources would undoubtedly serve the same purpose in producing immunity as the entire blood, and it is possible that in some cases where the red cell destruction is severe, the peripheral blood may contain extra-corporeal parasites, though this is doubted by Smith.

The number of corpuscles affected often reaches ½ to 1 per cent., but if this number is exceeded fatal results usually attend. If recovery takes place as the fever subsides, the number of parasites decreases. Dr. Cary and the writer have found Wright's stain most satisfactory for demonstrating the Piroplasma and unless one has plenty of time to hunt and a mechanical stage to assist in the search, it is better to await a fatal case and secure smears from the heart muscle, kidney or liver.

August Mayer, having had disastrous personal experience with the ticks, makes out a strong case against

that carrier of disease. He estimates that a cow can carry as many as half a million ticks of different stages of growth, and since four different broods may be carried in one season, a single animal may in one season furnish food for a million ticks. Three hundred thousand ticks will withdraw 200 pounds of blood from their victim, a loss nearly as great as can be replaced by an animal under conditions to make the greatest gains. This is a direct loss independent of the destruction of the blood cells within the body.

It has been frequently shown that, when an animal has been subjected to accidental or experimental hemorrhage of a degree approaching in severity the loss in Texas fever, that the natural regeneration of the blood occurs in several days. In these cases of simple hemorrhage the processes of regeneration consists in, first, a slight apparent increase in the number of corpuscles due to concentration, followed by a diminution due to replacement of a volume lost by fluid free from corpuscles and then a gradual replacement of the lost cells by the peculiar processes of cell division. In Texas fever there is a loss of red cells due, not to their withdrawal from the vascular system, but to their destruction within the vessels and the debris there formed has to be eliminated. This overtaxes the liver and ultimately the kidneys. To the presence of this waste substance may possibly be attributed the various symptoms of the disease that can not be accounted by the results of a simple removal from their functionating power of a large number of red blood cells.

Not the least interesting part of Texas fever is the condition in which it leaves the great mass of cattle that live from year to year. The so-called "immunity" in southern cattle is not a true immunity but rather a tolerance of the parasite, that keeps the animal from suffering an acute attack of the fever under ordinary circumstances. However, it is a condition of unstable equilibrium and a slight environmental change, such as

intense heat, severe exertion, adverse change of blood, or certain undetermined factors tending to lower the animal's resistance; or, on the other hand, a slight or considerable increase in the number of the invading organism, suffice to bring on acute and often fatal attacks of the fever. Many cases can be recalled to prove the soundness of this theory. Northern cattle can not come safely South, southern cattle can not stay safely South. The suggestion by Dr. Schroeder is timely, that some one in the South make an extended examination of the blood of a herd of tick infested cattle. The blood picture secured in such an investigation would make an interesting comparison with the results at hand on the blood of northern cattle.

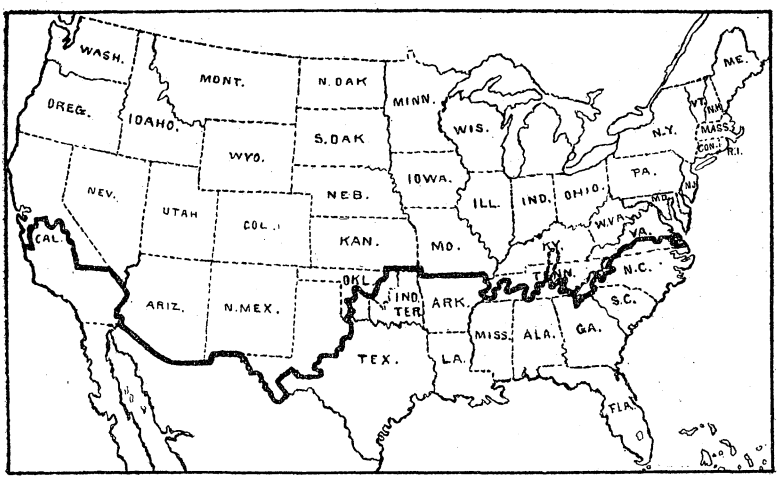


FIG 1.—Boundary line of the district infected with Texas Fever. (From Bureau of Animal Industry Bul. 258.)

LIFE HISTORY OF THE CATTLE TICK.

The large, fat female tick when completely filled with blood taken from its host, drops to the ground, crawls under leaves, litter or down into manure heaps and in a few days begins to lay eggs. In six to fifteen days she may lay 1,500 to 4,000 eggs. As the female lays eggs she gradually shrinks in size and dies in a few days after lay-

ing her last eggs. The eggs are small, oval, brown and waxy. They may hatch in 12 to 30 days after being deposited by the old female, or may live over winter and hatch in the spring. We have taken no records in Alabama where they hatched in less than 20 days. From the 1,500 to 4,000 eggs come the same number of seed ticks. These are six-legged, lively, brown larval ticks and a little larger than chicken mites. They crawl upon grass blades, weeds, shrubs or any object near their locality, and there await the coming of a cow, or or other animal. But the seed tick can not eat grass, weeds or anything else except the blood of cattle, horses or mules, and unless the seed ticks can get blood they will starve to death in one to four months in summer and one to seven months in winter. When they get upon cattle, they crawl up to the soft and thin parts of the skin, and begin to suck blood from the host. This is the time they inoculate the cattle with the Micro-parasite of tick or Texas fever. In about six days the seed tick sheds its skin (molts) and then becomes an eight-legged nymph. In eight to twelve days more the nymph tick sheds its skin (molts) a second time. Up to this time the male and female are about the same size, and just after the second molting the female becomes fertilized. The male grows little if any larger, but the female gradually enlarges for six to twelve days and then rapidly becomes engorged with blood during the next two or three days before dropping off the cow or ox. Thus the life cycle is completed. The shortest time of the life cycle is about thirty-five days in summer and six to eight months in winter.

A tabulated statement of the life history of the cattle tick for summer and winter may be stated as follows:

SUMMER.	WINTER.
May to October	October to May.
1. Egg laying time—6 to 15 days	30 to 60 days.
2. Hatching time—12 to 30 days	30 to 210 days.
3. Seed tick may live without getting on cattle, horses or mules 30 to 120 days.	30 to 240 days.
4. After attaching to the skin of cattle, females mature and drop off in 15 to 35 days	25 to 60 days.

EXPLANATION OF FIGURE 2.

1, larva of cattle tick (×25); 2, same (natural size); 3, mature female and eggs; 4, hide showing cattle ticks; 5, blood cells cells containing Texas-fever protozoa (× 1,000); 6, male cattle tick(× 15), 7, same (natural size); 8, young female cattle tick (× 15); 9, same (natural size); 10, various stages of cattle ticks.

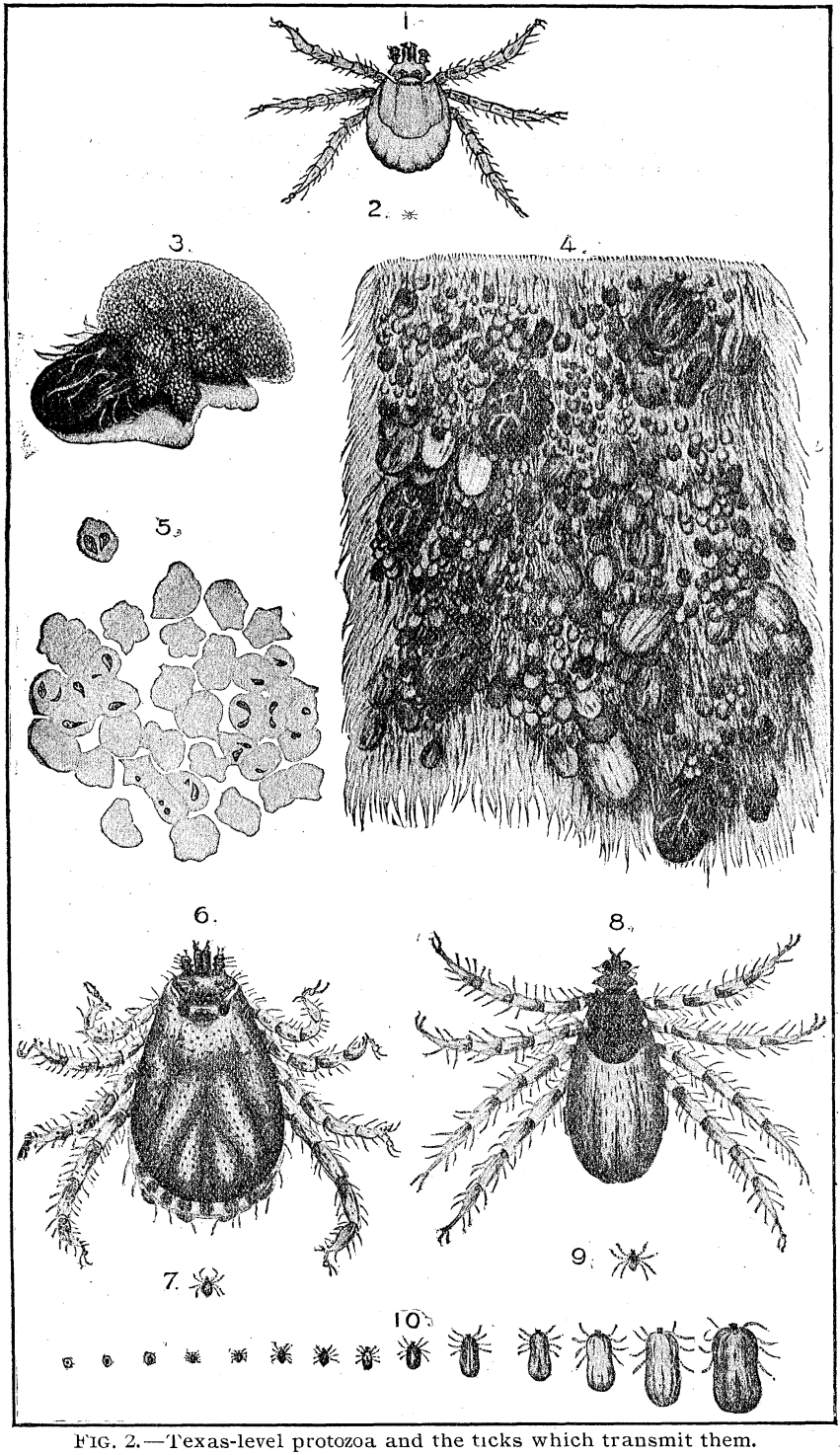


FIG. 2.—Texas-level protozoa and the ticks which transmit them.
(From Bulletin 258 of Bureau of Animal Industry.)

Symptoms of Tick Fever.

1. The presence of small ticks or large ticks should lead one to expect sick cattle to have tick fever. Frequently the ticks are so small that the ordinary observer can not see or find them. Twenty-five infected seed ticks applied to a non-immune may produce tick fever. A cow or calf may have a hundred seed ticks on it and they may not be seen or found by an inexperienced observer. Look closely and feel carefully on the inside of thighs, on the escutcheon, on the abdomen, drew lap and all over the body.

2. Determine the history of the sick animal or animals. Have they been moved from a non-ticky place to a tick infested one? Or have ticky cattle been brought into the pasture? Staked cattle are usually free of ticks and non-immune. Many town cows are tick free and susceptible. All very young calves are susceptible. All cattle from above the quarantine line and all cattle from tick free places or farms are susceptible to tick fever.

3. The temperature rises before any other noticeable changes occur in the infected animal. The normal ranges from 101 to 103 degrees Fah. and the fever will range from 103 to 107. The temperature will be higher at night or late afternoon than in the morning. The high temperature may continue for two to ten or more days, then drop to the normal. In chronic cases there may be variable periods of rising and falling of the animal's temperature. Just before death the temperature falls and sometimes to sub-normal.

4. The appetite is lost in acute cases and is variable and capricious in chronic cases. Rumination is also suspended in acute cases and is not resumed until recovery begins.

5. The bowels may be inactive. Loss of appetite, suspension of rumination, and inactivity of the bowels indicate that the functions of the alimentary canal are suspended. The lining of the intestines and fourth stomach may be more or less inflamed and the inactivity may be

in part due to this inflamed condition. Inactivity of the bowels may be due to paralysis resulting from the action of toxic waste products on the nervous system and to excessive action of the kidneys. The third stomach or manifolds may contain very dry food material. This is due to the high fever and the excessive loss of water from the system. Generally in the early stages of tick fever, the bowels are more or less loose and sometimes a condition similar to diarrhoea may be present. The feces or manure may sometimes be streaked with blood or covered with mucous and sometimes it is greenish yellow in color as a result of an excessive amount of bile in it. Sometimes the feces are black. Gases may distend the stomach and intestines when the food is undergoing fermentation. This occurs in long standing inactivity of the bowels. Again the condition of the bowels varies with the food the animal has eaten. Green feeds and cotton seed are laxative in action, while dry feed is constipating. Plenty of water helps to keep the bowels open.

6. Respirations are accelerated in acute cases, the animal breathes shallow and quick as in congestion of the lungs. This is caused by stimulation of the respiratory center, which is excited by an excess of carbon dioxide and a deficiency of oxygen in the blood.

7. The pulse in acute cases is rapid, soft and weak. In chronic cases it may be slow and weak.

8. The kidneys are usually very active in acute cases. In mild cases the urine may be quite dark in color, and in severe cases it may be blood red. This is not blood but the coloring matter of the broken down red blood cells. Not every case will pass red colored urine, but some cases among a number of sick animals will pass red colored urine. This is one of the most positive symptoms of tick fever; and many persons call it "red water" or "bloody murrain" on account of the red colored urine.

9. Some cases get very weak, wabble around, fall and lie down most of the time or until dead.

10. Some chronic cases have a cough and stand

around with head down and back arched, and usually become separated from the rest of the herd. They prefer the shade and are fond of standing in the water.

11. Some cases become wild and somewhat crazy or violent. This is due to insufficient or improper supply of blood to the brain or to absorption of toxic materials from the stomach or intestines. A wabbling gait and inability to see may also be present.

12. An animal in fairly good condition rapidly loses flesh and becomes tucked up in the abdomen.

13. Cows will often abort during or after an acute or sometimes after a chronic attack of the fever. Bulls lose their vigor and are often useless for breeding for one or two years.

14. A small swelling may appear under the lower jaw or between the branches of the lower jaw. This is usually present in chronic cases and is generally associated with a cough.

Diagnosis of Tick Fever.

1. The positive test is finding the micro-parasite in the red blood cells. This is rather difficult to do before the animal dies, because it is not often that the piroplasma is found in the blood of the skin or subcutis in sufficient numbers to be easily and quickly found. Slide smears of the blood taken from the heart muscle or the kidney will usually contain numerous intra-corpuscular parasites. The blood may be stained with Loefflers alkaline methyl blue after it has been fixed by heating up to 110 to 120 degrees C. for 2 hours. The stain should remain on the slide for one to one and a half minutes, wash in water and then dip for an instant into a one-third per cent. acetic acid solution to remove the excess of diffuse stain in the red blood cells; wash in water and mount in water or dry and mount xylol balsam or dry and examine by using immersion oil on the slide.

With Wright's stain the blood smear will need no fixing; keep the stain in the slide for one to five minutes;

wash with water, dry and examine with high power. The writer was the first one to use Wright's stain in demonstrating the piroplasma of tick fever in the blood of cattle.

2. Black Leg or Black Quarter is often confounded with tick fever. This usually attacks young cattle under two years old and not very young calves or older cattle. It usually attacks fat yearlings instead of the poor ones. Before death and after death there is a swelling over the upper part of a front limb or hind limb or on some part of the body. This swelling crackles when the hand is rubbed over it, indicating the presence of gas under the skin. Cutting open the swelling permits a dirty red liquid to escape and exhibits muscle and connective tissue that appear as if they had been par boiled. Smears from this may be stained and the specific bacteria of black leg may be found. Also the material may be injected under the skin of a calf, sheep or a small laboratory animal and produce the specific disease.

3. Haemorrhagic septicaemia is not unlike a chronic case of tick fever. The presence or absence of the piroplasma will identify the one or the other. This characterized by well defined haemorrhages and numerous haemorrhagic spots under the pleura, peritoneum and epicardium. Sometimes the urine is stained red but not as frequently so as it is in tick fever. This disease is said to be caused by a specific germ (*Bacillus bovi-septicus.*) The outbreaks of this trouble are localized.

4. Anthrax may be mistaken for tick fever or the reverse may be true. In this the specific germ, *Bacterium anthracis,* may be found and it attacks horses, mules, cattle, sheep, goats, rarely hogs and occasionally man.

5. Stomach worms and hook worms in the alimentary canal may produce an anaemia not unlike that of chronic tick fever. In this, search for the worms in the feces of the suspected cases. These worms and tick fever may both be present in an animal at the same time.

TABLE I. *A Comparative Study of Four Specific Diseases.*

Disease	Haemerrhagic Septicaemia	Anthrax or Charbon	Black Leg	Tick fever
Cause	Bacillus bovisepticus	Bacterium anthracis	Bacillus Feseri	Piroplasma bigeminum (a protozoan)
How spread	Unknown	Food, water, flies, carcasses, etc.	Food, water, discharges, carcasses, etc.	Cattle ticks
Extent of single outbreak	Localized	Local centers and wide spread	Local. Often one farm or one pasture	Tick infested areas
Favorable season	Any season	Hot, dry weather after wet spring	Spring, summer and fall, hot and dry	Summer and fall but may occur any season
How germ enters body	Unknown	Digestive tract, lungs, skin	Skin (?)	Tick inoculation through skin
Susceptible Animals	Nearly all	Horses, mules, cattle, sheep, goats, man	Young cattle, sheep, goats	All cattle at some life period
Mortality	Very high	Very high	Very high	High in old cows and low in young cattle
Beginning and course	Acute, sudden. Chronic slow	Usually rapid	Generally rapid	Acute, rapid; chronic, slow
Local swellings	Slight or absent	Acute, occasional; Chronic, frequent	Very marked and gas under skin	Absent usually
Urine	Rarely blood stained	Often blood cells, stained or dark	Rarely blood cells stained or dark	Often blood stained or dark, albumen
Manure	Often blood stained	Often blood and mucus	Constipation and manure bloody	Blood stained, mucus and bile
Blood after death	Normal and clotted	Dark, tar black, clots, slow or slight	Normal, except at swelling	Thin, light in color and clots slowly
Haemorrhages	Often present and clearly defined	Spleen often ruptured	None	Usually none
Serous surfaces	Numerous blood spots on them	Blood spots and red serum in serious cavities	Serum in abdomen	Blood spots on epicardium and endocardium
Spleen	Normal, except surface blood spots	Large, dark and soft	Normal	Very large, soft, blue-black
Liver	Blood spots on surface	Engorged with dark blood	Usually engorged	Engorged with blood and bile
Kidneys	Blood spots on surface	Congested usually	Normal or engorged	Sometimes pale, usually engorged and black
Lymph glands	Blood stained near blood lesions	Often red or black and large	Normal	Slightly enlarged rarely red

AFTER DEATH CONDITIONS.

1. If the animal was sick for several days, the carcass will show emaciation, but fat animals may die suddenly and then the carcass indicates that the animal was in good condition as to flesh and nourishment.

2. In cutting through the skin it appears pale, as if there were little or no blood in the skin or subcutis. When blood is found in these tissues it appears "watery" or "thin" and does not coagulate readily.

3. The rumen or paunch may contain more or less semi-liquid material. The third stomach or manifolds, usually, in acute cases, contains very dry feed. The mucous membrane of the fourth stomach and of the small intestine will exhibit raw or eroded surfaces or patches. The contents of the intestines may exhibit an excess of bile, some blood and mucous, and the fecal matter may be soft or more or less dry and hard.

4. The spleen is usually enlarged or engorged with blue-black blood. A cut surface will let the contents flow out and it will appear like black-berry jam in color and consistency. This is broken down red blood cells and waste materials of the blood.

5. Kidneys are congested and often enlarged in acute cases. In chronic cases they may appear normal to the naked eye.

6. The bladder may contain red colored urine, dark colored urine, normal colored urine, or be empty. As a rule in a number of cases that die of tick fever, red urine will be found in some of the cases.

7. The liver is usually greatly enlarged and filled with blood and bile having a brown mahogany or yellow color. The gall bladder is distended and the bile is thick with flakes of mucous.

8. The lungs may be congested or may be normal.

9. The peritoneum and pleura may present a few colored patches or haemorrhagic spots or patches. These are not constant.

10. The heart may have the right ventricle "distended

with blood, full or clotted, according to the time elapsing between death and the examination. The left ventricle is usually firmly contracted and may contain a small quantity of fluid or clotted blood." (Smith.) The small haemorrhagic spots under the epicardium and endocardium are quite constant, they are more numerous on the outside and inside of the left ventricle.

11. The subcutaneous tissues, the mucous membranes of the mouth and eyes may become more or less yellow in acute tick fever cases. The fat of the body may be also yellow. The yellow coloring of white tissues is due to an absorption of bile. It is not always present. And yellow fat is not always due to tick fever. In many cases the mucous membranes of mouth and eyes are very pale.

12. Secure smooth slide smears of blood from the kidneys, the heart muscle and the liver. Stain with Wright's stain and examine with high power lens for the intra-corpuscular micro-parasite. Or examine with high power a fresh mount of blood from a kidney or the heart muscle for the micro-parasite.

IMMUNITY.

Immunity to tick fever is a relative term. It is not absolute. When an animal is not susceptible to an attack of a given disease, the animal is said to be immune to that disease. Immunity may be acquired by having the given disease one or more times, by natural resistance of certain species of animals for certain diseases, by introducing specific anti-toxins into the animal body. In tick fever, the only known means of producing immunity in cattle is by giving the animal one or more mild or severe attacks of the fever. Blood inoculation, or artificial tick infestation, are the only ways of artificially producing this immunity. Natural tick infestation may also produce immunity in a varying degree. The fact is that a cow, steer or ox must have an attack of tick fever once every year or several times every summer or its immunity is lost within two or more years. Just as a man can have a series of attacks of malaria so may cattle have a series

of attacks of tick fever. It is true that one cow has been known to carry the micro-parasite in her blood for thirteen years; but thousands and thousands of native southern cattle that have had one or more attacks of fever, die every year from one severe attack or several attacks in one season.

Moreover, it is not infrequent that animals upon the range or in pasture pass through a time of gross infestation of ticks and then die in the winter from chronic tick fever or an acute tick fever brought on by reduced resistance and cold weather. A man may have malaria year after year if he is exposed to new infection every year. So may cattle have tick fever one or more times each year if they are exposed to gross tick infestation.

The micro-parasite of tick fever varies in virulency and cattle vary in their degree of susceptibility or resistance. Moreover, the resistance or susceptibility of the individual animal varies with the condition of the animal, its age and its vitality or vigor. A very fat or a very poor animal possesses low resistance; an old animal is less able to throw off the waste products and repair the loss of blood cells than a young one; a weak animal from any cause is also less resistant. Yet there are individual animals that have a low index of resistance from a condition of the blood or from some unknown cause. And there are times when the micro-parasite acquires an increased virulency. The passing of the parasite through non-immunes or the frequent and rapid transmission of it through cattle is said to increase its virulency. This in part accounts for the greater virulence of parasites and the greater number of deaths in native cattle in the fall. The micro-parasite has passed through two or more generations of ticks and through the body of one or more animals, without having low temperatures to reduce or retard its activity.

Inoculating With Infected Blood.

1. First inoculate suckling calves or cattle that are in good healthy condition, eight to twelve months old. Older cattle are much more frequently killed.

2. Inoculate any time from the last of November to the last of March, and it is always best to inoculate the cattle in the South near the place where they shall live.

3. For the infected blood secure a two year old heifer, steer or bull that has had tick fever within a year, or that has had a gross infestation of cattle ticks during the second summer of its life.

4. Secure a sterilized hypodermic syringe (capacity 2 to 3 drams) having two or more strong and sharp sterilized hypodermic needles, a pair of scissors and a sharp scalpel knife, three or four small sterilized, one ounce, breakers or wide mouth bottles, containing a sterile glass rod or small sterile spoon; some absorbant cotton, and some 5 per cent. creolin or other good antiseptic.

5. Every animal to be inoculated should be tied or haltered in a narrow stall before the blood is drawn.

6. Cast the two year old from which the blood is to be drawn or secure it in a standing position. Clip the hair or clip and shave the hair over the jugular furrow or vein and wash with creolin solution and absorbant cotton. Have the assistant to press on the jugular vein near the base of the neck. Press the large hypodermic needle or an aspirating needle into the jugular inclining the point forward and inward. When the needle penetrates the vein the blood will flow freely through the needle. Catch the blood in the sterile beaker or wide mouth bottle. When the beaker or bottle is nearly full, let an assistant take it and stir the blood vigorously and continuously with the sterile glass rod or spoon. The quantity of blood drawn may be regulated according to the number of cattle to be inoculated. As soon as possible after drawing the blood, fill the hypodermic syringe with blood and inoculate the cattle as rapidly as possible, injecting one cubic centimeter under the skin of each animal. The side of the neck and over the shoulder are convenient places for the injection.

7. The dose of blood varies with the age. A young animal will take a relatively larger dose than an old one.

One cubic centimeter is enough for any animal and I have killed old cattle with one-half a cubic centimeter of blood. The second inoculation should be a dose two to three times as large as given at the first.

8. If the first inoculation is made about Dec. 1st the second may be given Feb. 1st to 15th. If the first inoculation produces a severe form of fever do not give a second.

Care of Cattle After Inoculation.

During the inoculation fever, green and laxative feed should be given to them. Have plenty of salt and good water within reach all the time. If the bowels become constipated, a dose (one to two pints) of raw Linseed oil or Epsom Salts (one to two pounds) will usually relieve the constipation. Avoid excessive use of drugs. The fever will run its course and must run its course if it produces any degree of immunity. Therefore, it is unwise to try to break up the fever with drugs.

When the inoculated animal gets off its feed and refuses to eat, wait with patience for one day or more before forcing any food down it. Sweet milk and fresh thin oat meal gruel may be given by bottle per mouth. Be careful not to strangle the animal in giving it. Calves respond well to such treatment, but older animals struggle more and are often injured by pouring the liquid down the trachea. It is not well to let a tick fever animal lie down all the time, especially if it can stand on its limbs and walk. Get it up, rub its legs and let it walk slowly, but not rapidly, for a short time. If the weather is hot and the animal's temperature is above 105 degrees Fah., the animal may be given a sponge bath three to six times per day.. Regulate the baths by the temperature of the air and the animal. When the temperature of the animal falls, stop the baths. If the inoculated animal passes the primary inoculation fever, the second rise of fever may occur between the twenty-fifth and the fortieth day

after the inoculation. It is at this time that some cases die. But good care may tide them over.

In preparing for winter inoculation always sow plenty of rye, barley, winter wheat and winter oats for green winter pastures. Nothing will carry cattle through the inoculation fever better than plenty of green pasture, supplemented with plenty of good hay or silage and some grain or concentrated feed like corn, oats and shorts and a little cotton seed. During the summer following the inoculation, see that the animal never becomes grossly infested with ticks. A good pasture, with an abundance of pure water, and salt in constant reach are essentials. Shade and running water or large pools into which the hot cattle can wade and stand will help. Remember that a large number of inoculated and tick infested cattle become stunted, and are poor breeders for one or two years.

TABLE II. *Record of all the Blood Inoculation Made at this Station up to Jan. 1906.*

KIND OF CATTLE	No.	Sex	Where Bred	Age	Immune	Non Immune	Times Inoculated with Blood	Deaths by Inoculation	Deaths during 1st. Summer.	State	County	Ticks Many	Ticks Few	
Hereford	1	Cow	Ky.	5 yrs.		yes	1			Ala.	Bullock		yes	
"	1	Heifer	Ky.	10 mos.		yes	1			Ala.	"		yes	
"	1	Bull	Ky.	1 yr.		"	1			Ala.	"		yes	
"	1	Bull	Ky.	6 mos.		"	1		1	Ala.	Tallapoosa			
"	1	Cow	Ky.			"	1		1	Ala.	Wilcox	yes		
"	1	Calf	Ky.	6 mos.		"	1		1	Ala.	"	"		
"	1	H.	Ky.	14 mos.		"	1		1	Ala.	"	"		
"	1	Bull	Ky.	18 mos.		"	1			Ala.	"	"		
"	1	Bull	Ky.	1 yr.		"	1		1	La.				
"	1	Bull	Ky.	1 yr.		"	1			La.				
"	1	Bull	Ky.	1 yr.		"	1			Ala.	Autauga		yes	Smith
"	2	Cows	Ky.			"	1			Ga.	McIntosh		yes	Davis
"	2	Bulls	Ky.	2 yrs.		"	1		1	"	"		"	"
"	1	H.	Ky.	2 yrs.		"	1		1	"	"		"	"
"	1	H.	Ky.	1 yr		"	1			"	"		"	"
"	1	Bull	Ky.	1 yr.		"	2			"	"		"	"
"	3	Calves	Ky.			"	1			"	"		"	"
"	1	Bull	Ky.	1 yr.		"	2			Texas			"	
"	1	Bull	Ky.	1 yr.		"	1			N. C.			"	
"	2	Bulls	Ky.	1 yr.		"	1			Ala.	Baldwin	"		
"	1	Heifer	Ky.	20 mos.		"	1		1	"	Baldwin	"		
"	1	Cow	Ky.	4 yrs.		"	1		1	"	Dallas	"		Packard
"	1	Calf	Ky.	6 mos.		"	1		1	"	"	"		"

TABLE II. *Continued*

KIND OF CATTLE	No	Sex	Where Bred	Age	Immune	Non Immune	Times Inoculated with Blood	Deaths by Inoculation	Deaths During 1st Summer	State	County	Ticks many	Ticks Few	
Hereford	1	Heifer	Ky.	14 mos.		yes	1		1	Ala.	Dallas	yes		Pachard
"	1	Bull	Ky.	2 yr.		"	1			"	"	"		"
"	1	Cow	Ky.	5 yrs.		"	1		1	"	Talladega	"		Hill
"	1	Bull	Ky.	1 yr.		"	1			"	"	"		Robinson
"	1	Heifer	Ky.	1 yr.		"	1			Ga.				Leigh
"	1	"	Ky.	18 mos.		"	1		1	Ala.	Hale	"		Allen
"	1	"	Ky.	1 yr.		"	2			"	"	"		"
"	2	Heifers	Ky.	2 yr.		"	1			"	Chilton			1 Died March 12, 1904, Gulledge
"	1	Bull	Ky.	15 mos.		"	1		1	"	Jefferson			Lovell
"	6	Heifers	Ky.	12 to 20		"	1			"	Clay	"		Street, 1 Heifer inoculated twice
"	1	Bull	Ky.	18 mos.		"	1		4	"	"	"		Street,
"	1	Cow	Ky.	6 yrs.		"	1			Cuba		"		Beattie
	5	Bulls	Ky.	2 yrs.		"	1			"		"		"
"	1	"	Ky.	15 mos.		"	1		1	Ala.	Clark			First District Agricultural School
"	1	"	Ky.	6 mos.		"	1			La.		"		Bland M. Pleasant, La.
"	1	"	Ky.	5 mos.		"	1			Ala.	Lee	"		Floyd
"	1	"	Ky	15 mos.		"	1			"	Chambers	"		Andrews
"	1	"	Ky.	12 mos.		"	1			Ga.		"		Maddox & Young, Moreland, Ga.
"	1	"	Ky.	3 yrs.		"	1	1		Ala.	Lee			Died 31 days after inoculation
"	1	H.	Ky.	2 yrs.		"	1	1		"	"			" 35 " " "
"	1	Cow	Ky.	6 yrs.		"	1	1		"	"			" 36 " " "
"	1	Bull	Ky.	14 mos.		"	1	1		"	"			" 39 " " "
"	1	Cow	Ky.	3 yrs		"	1	1		"	"			" 34 " " "
"	1	Bull	Mo.	1 [illegible]		"	1			"	Sumter		"	H. A. Haralson, Coatopa, Ala.

TABLE II. *Continued*

KIND OF CATTLE	No	Sex	Where Bred	Age	Immune	Non Immune	Times Inoculated	Deaths by Inoculation	Deaths During 1st Summer	State	County	Ticks Many	Ticks Few	
Hereford	1	H.	Mo.	1 yr.	....	yes	1	....	....	Ala.	Sumpte		yes	H. A. Haralson Coatopa Ala
"	9	H.	Mo.	8to 18m	....	"	1	....	....	"	Dallas	yes		J. E. Dunaway, Orrville, Ala.
"	1	Bull	Mo.	10mos.	....	"	1	....	....	"	"	"		" " "
"	1	"	Va.	10 mos.	....	"	2	....	....	"	Lee	"		C. G. Lee, Opelika, Ala.
"	40	H. & B.	Ky.	12mos.	....	"	3	....	6	"	Talladega			Giltner Thornton Cattle Co.
Angus	2	Bulls	Mo.	8 mos.	....	"	2	....	....	Texas		"		Robert Adams, Alford, Texas,(Elliotts)
"	1	"	"	10 "	....	"	2	....	....	Ala.	Lee	"		Whatley, Opelika, Ala. (Elliotts)
"	5	"	"	7 to 10	....	"	2	....	....	"	Sumter	"		W. G. Little, Livington Ala. (Elliotts)
"	4	Heifers	"	6 to 11	....	"	2	....	....	"	"	"		" " " " "
"	4	"	"	8 to 12	....	"	2	....	....	"	Washington	"		H. K. Milner, Birmingham, Ala. "
"	3	Bulls	"	8 to 14	....	"	2	....	....	"	"	"		" " " " "
"	1	"	"	8 mos.	....	"	2	....	....	"	Talladega	"		N. C. Rew, Talladega, Ala. "
"	1	Heifer	"	6 "	....	"	2	....	....	"	"	"		" " " " "
"	1	Bull	"	6 "	....	"	2	....	....	"	Macon	"		C. F. Darnell, Notasulga, Ala. "
"	2	"	"	12 "	....	"	2	....	....	"	Talladega	"		W. L. Thornton, Talladega, Ala. "
"	1	Heifer	"	7 "		"	2	....	....	"	Lee	"		Ala. Experiment Station "
"	1	Bull	"	12 "	....	"	2	....	....	"	"	"		" " " "
"	1	"	"	12 "	....	"	2	....	....	"	Lowndes	"		J. E. Callier, Calhoun, Ala. "
"	1	Heifer	"	7 "	....	"	2	....	....	"	"	"		" " " "
"	1	Bull	"	7 "	....	"	2	....	....	"	Colbert	"		J. S. Kernachan, Florence, Ala. "
"	1	"	"	6 "	....	"	2	....	1	Cuba		"		W. F. Ward, Auburn, Ala. "
"	1	Heifer	"	5 mos.	....	"	1	....	....	Ala.	Sumter	"		W. G. Little Livington, Ala.
"	1	"	"	3 mos.	....	"	1	....	..	"	"	"		C. J. Smith, " "
"	2	"	"	5 mos.	....	"	1	....	....	"	"	"		Allison Bros., Bellany, " 1904
"	1	"	Ky.	20 mos.	....	"	1	....	....	"	Lowndes	"		Norwood & Callier, Calhoun, Ala. 1905

TABLE II. *Continued*

KIND OF CATTLE	No.	Sex	Where Bred	Age	Immune	Non Immune	Times Inoculated	Deaths by Inoculation	Deaths 1st Summer	State	County	Ticks Many	Ticks Few	
Angus	1	Heifer	Ill,	33 mos	....	yes	1	....		Ala.	Lowndes	yes	.....	" " " "
"	1	Bull	Ky.	9 mos.	....	"	1	....		"	"	"	.....	" " " "
"	4	"	Ky.	8-12	....	"	1	....		"	Wilcox	"	.....	Boykin, Akerville, Ala.
"	5	Heifers	Ky.	8-12	....	"	1	....		"	"	"	.....	" " "
Short Horn	34	"	Tenn.	8-18mos	....	"	1	....		"	Dallas	"	.....	J. E. Dunaway 1903-'04
"	1	Bull	"	8 mos.	....	"	1	....		"	"	"	.....	"
"	15	"	Mo.	12 to 15	....	"	2	....	5	Tex.	.....	"	.....	Amer. Short Horn Breeders Ass. 1904-05
"	1	"	Iowa	15 mos.	....	"	2	....	1	Ala.	Chambers	"	....	A. S B. A. Slaughter, LaFayette
"	2	Heifer	Mo.	12 to 15	....	"	2	....	1	"	"	"	.....	A. S. B. A. " "
"	1	Bull	Mo.	12 mos.	....	"	2	....		"	Lee	"	.....	" Edwards, Opelika, Ala.
"	2	H.	Mo.	10 mos.	....	"	2	....	1	"	"	"	.....	" " " "
"	1	Bull	Mo.	12 mos.	....	"	2	....		"	Dallas	"	.....	" C. Kirkpatrick, Cahaba
"	1	"	Mo.	14 mos.	....	"	2	....		"	Perry	"	.....	" S. L. Scott, Marion, Ala.
"	1	Heifer	Mo.	12 mos.	....	"	2	....		"	"	"	.....	" " " "
"	1	Bull	Kan.	14 mos.	....	"	2	....		"	Lee	"	....	" G. C. Floyd, Opelika "
"	11	Heifer	Mo.	7 to 12	....	"	2	....		Miss.	.....	"	.....	" A. T. Stoval, Okalona, Miss
"	5	"	"	8 to 12	....	"	2	....		Ala.	Washington	"	....	" H. K. Milner
"	2	Bulls	"	12 mos.	....	"	2	....	1	"	"	"	.....	" "
"	1	"	"	12 mos.	....	"	2	....		"	Sumter	"	.....	" W. G Little
"	1	Heifer	"	12 mos.	....	"	2	....		"	"	"	.....	" R. Seale
"	2	"	Kan.	12 mos.	....	"	2	....		"	"	"	.....	" "
"	4	"	Mo.	10 mos.	....	"	2	....		"	Clay	"	.....	" J. C. Street, Opelika
"	1	Bull	"	10 mos.	....	"	2	....		"	"	"	.....	" " "
"	1	"	"	10 mos.	....	"	2	....		"	Lee	"	.....	" T. Wimberly

TABLE II. *Continued*

KIND OF CATTLE	No.	Sex	Where Bred	Age	Immune	Non Immune	Times Inoculated	Deaths by Inoculation	Deaths During 1st Summer	State	County	TicksMany	Ticks Few	
Short Horn	1	"	Mo.	12 mos.	....	yes	2	....		Ala.	Lee		yes	A. S. B. A. Ala. Expt. Station
"	1	"	Ky.	15 mos.	....	"	1	....			Dallas	yes	.....	" C. Kirkpatrick Cahaba,'05
"	9	Heifers	Ky.	8 to 10	....	"	1	....			"	"	....	" " " '04
"	16	"	Ky.	6 to 10	....	"	1	....	6		"	"	....	" " " '05
"	2	Heifers	Ky.	4 to 7	....	"	1	....	1		Marengo	"	.....	R. Seale Livingston, Ala.
	1	Bull	.....	6 mos.	....	"	1	....			Sumter	"	.....	Edmonds, Coatopa, Ala.
	1	Bull	.....	4 mos.	....	"	1	....			Sumter	"	.....	J. L. Horn, Coatopa, Ala.
"	1	Bull	.....	10 mos.	....	"	1	....			Butler	"	.....	J. T. Watt, Greenville, Ala.
"	1	"	Mass	8 mos.	....	"	1	....			Elmore	"	.....	W. E. Benson, Kowaliga, Ala.
"	2	"	.....	4 to 7	....	"	1	....	1		Marengo	"	.....	R. L. Seale, Livingston, Ala.
"	9	Cows	Pa.	1 to 16y	....	"	1	2			Macon	"	.....	Tuskegee Normal School 1903-1904.
"	3	Bulls	Pa	2 to 3	....	"	1	....			Macon	"	.....	" " "
"	5	Bulls	Ky.	8 to 12	....	"	1	....			Talladega		.....	Giltner Thornton Cattle Co.
"	6	Bulls	Ky.	8 to 12	....	"	1	....			Wilcox		.....	B. L. Boykin, Ackerville, Ala.
"	37	Heifers	Ky.	8 to 12	....	"	1	....	2		Wilcox		.....	" " "
Gurnseys	11	Cows	N.Y.	1 to 12	....	"	1	2			Macon	"	.....	Tuskegee Normal School 1903-1904
Holstein	7	Cows	Pa.	2 to 9	....	"	1	2			Macon	"	.....	" " " "
"	1	Heifer	N.Y.	8 mos.	....	"	1				Sumter	"	.....	W. K. Pickens Livingston.
Jerseys	9	Cows	Pa.	1 to 12y	....	"	1	2			Macon		.....	Tuskegee Normal School 1903-1904.
"	3	Cows	Ky.	4 to 12	....	"	1	7			Lee		.....	1903-1904
Grades	70	Cows	Pa.	1 to 16	....	"	1–2	1	2		Macon	"	.....	Tuskegee Normal School
"	1	"	Ky.	7 yrs.	....	"	1						.....	
"	1	"	Ky.	6 yrs.	....	"	1						.....	
"	1	"	Ky.	4 yrs.	....	"	1						.....	
"	1	"	Ky.	15 yrs.	....	"	1		1				.....	
Total 448					....			21	48				.....	
45					....				4				.....	No. inoculated previous to the 448
Total 493					....			21	52				.....	Total No. up to Jan. 1 1906.

Table II gives a record of all blood inoculations up to January 1, 1906:

The percent of deaths from inoculation is__ _____	4.26
The per cent. of deaths the first summer after inoculation	10.54
The total per cent. of deaths.....	14.80

One hundred or more of these cattle were too old and not a few were either too fat or too poor to withstand the inoculation. Out of 106 inoculated at Tuskegee, 15 died of inoculation fever and only one died during the first summer. The majority of the 106 were over two years old. While the average per cent. of deaths is high, taking the cattle at any age as they come and in all conditions; with a great variety of kinds of care and treatment, the losses are not as great as one should expect were like conditions presented.

Selected Temperature Records Following Blood Inoculations for Immunity.

TABLE III

DATE	46		169		58		32		37		86	
1904–1905	a m	p m	a m	p m	a m	p m	a m	p m	a m	p m	a m	p m
December 1	103.8	105.1	102	103.1	101.3	102.3	104	105	103.1	104	101.2	103.3
2	103.2	103.8	104	104	104.2	104.1	104	104.4	103.4	103.8	104.3	104
3	104.5	103.9	104	103.9	104.2	104.5	104	104.1	102.2	105.4	103.5	105.4
4	102.9	102.5	103.8	103.1	104	103.4	104.9	103.2	105.4	103.5	104.2	104
5	103.8	103.5	105	103	103.2	104.5	104.5	104.2	104.5	105	103.9	104.5
6	101.5	103.8	103.1	102.8	101.4	102.5	105.1	104.5	103.4	104.8	102.9	104.2
7	101.8	102.9	101.8	104.5	103.4	103.4	104.9	105	103.1	104.5	105	106.1
8	105.4	104	102.8	102.2	105	104.4	103.5	104.8	104.8	105.5	105	104.2
9	104	105.9	102	102.2	104.5	104.1	104	105.1	105.1	106	105.9	105.9
10	105.9	104.1	103.4	102.5	105.1	104.8	104.1	101.8	105.5	106	104.5	105
11	101.5	106	101.5	102.9	104.8	104.1	103.5	103.1	102	103	104.5	102.9
12	103.1	103.8	102.8	102.2	102.5	101	103.5	103.1	103.5	102.9	104.8	103.8
13	101.9	104	102	103.8	101	102	101	103	101.5	101.9	103	103.8
14	103.9	101.8	101.2	102.4	101	101.3	103.1	103.1	102.9	102.9	101.1	102.9
15	102	102.3	101.9	102.3	101	101.3	103.8	103.6	103.9	103	101.9	102.8
16	101	102.4	102.1	101.9	101.9	102	103	104	104	103.1	101.5	101.5
17	102	102.4	102	102.6	102	102.5	104	102.8	103.2	102.6	103.9	103.3
18	101	102.5	102.5	103	101.8	102	104	105.4	103.1	102.9	102.1	104.5
19	101	102.9	101.8	102.9	103	102.9	102	103	102.1	103.2	102.9	103.8
20	101	103	102.4	103.8	102.1	103.2	102.9	104.5	101.9	102.8	103.9	103
21	101.5	104	102	103.5	103	104.9	102.4	103	102	103.2	102.9	104.5
22	101.8	101.9	100.9	102.9	104.5	105.9	103.9	103.5	102.8	103.4	102	102.9
23	102	103.8	101.8	103.8	106.5	106.9	103	103.8	103.5	106	102	103.5
24	102.9	102.4	102.8	101.8	105	102.6	103.8	101.5	105	102.4	102.8	100.2
25	103.4	104	103.4	102.4	102	103.2	103.5	104.6	102.6	102.8	103	103
26	103.8	104.2	103.4	102.3	102	104.6	104	106.1	103.2	102.5	103.2	103.3
27	102.5	99	102.6	101	102.8	100.4	104.6	103	103.5	99.6	104	100.3
28	101.3	101.9	103.6	103.3	101	103.3	102.2	101.8	101.8	104.5	101.3	102
29	101.7	102	102.8	103.5	101.5	102.9	101.3	102.9	101.7	102.4	102.2	102 4
30	101.2	102.8	104	105.4	102	103.2	102.9	103.5	101	101.9	105.5	104.4
31	102	102.9	102.5	104.5	103.5	103.8	104	104	101	103.2	100.9	103.8
January 1	101.4	102.9	102.2	103.9	103.9	105.2	104	105	101.9	102.6	103	104.4
2	103	102.8	102	105.5	103.9	103.9	105	105	102.9	103.2	102	100
3	102	103	102.9	105.2	103.9	104.2	103.9	105.5	102.8	104.2	102.9	103 5
4	102.5	102.9	100.9	104.8	101.9	102.5	105	103.9	102.9	103.8	102	104
5	103.5	104	102	104.5	102	103.5	105.8	103.6	103.5	104.9	103	103.6
6	103.5	103.9	104.5	104.5	103.9	103.6	105.4	104.8	104.5	103.5	103.5	104 5
7	102.5	103.8	103.4	105.2	102.9	104.2	104.2	105.9	103.9	104.5	103.5	104
8	104	104.5	104	104.9	103.8	104.9	103.5	107	105	105	102.5	104
9	103.9	103.8	103.4	103.9	104	105	103.2	104	104.4	102.5	104.4	104.5
10	104	103.2	103.5	104.8	103	104.8	103.5	103.8	104	105.8	105	105.2
11	103	102.2	102.5	104	105	102.9	104.4	105.5	104	106	104	104.5
12	103.2	102	104	103	104.9	103	105	103.5	105.2	105	105.5	104.2
13	103	102.5	104.2	102.5	103.2	102.8	104.5	102.5	105	104.5	105	103.8
14	102.5	104.5	102.4	102.5	102.9	102	102	103.5	103.5	101.2	104.4	103.8
15	101.9	104	101.8	102.5	101.5	102.2	102.8	101.5	104	104	102.8	105
16	104	104.5	101.5	103.5	101	102.5	101.8	102.8	103.2	104.5	102 4	104 8
17	102.4	103	100.9	104	100.5	102.5	102.4	103.5	103	104	101.5	103.2
18	102	103.2	100.5	102	101	102	103	104	103.5	104.4	101.2	103
19	102.5	103	101.9	101.9	102.5	104.5	104.5	104.5	103	103.5	103	102 5
20	102.9	102	101	101.5	104.5	103.5	103.9	102	103	103	103.5	103
21	101.4	102.5	101.5	101.5	103	104	102.9	104.5	102.5	102	101	103.2
22	101.5	102.5	102	101.5	102.5	101.5	103.5	102.5	102.5	104	101 5	102 4
23	101.9	101	101.5	100.5	100.4	102.9	101.9	101.5	102 5	102 5	102 4	102
24	103.4	102.5	100.5	101.9	101.5	101.8	103	103	101	102.8	101.9	103
25	100.9	101	101	102	100.5	101.2	102.5	101.5	102	102 5	101	101.9
26	101.5	102.5	102.5	101.9	100.5	102.5	102.4	101.9	101.5	101.5	101 8	101
27	102.2	102.5	103.2	102	101.9	101.2	102.5	102.9	101	103.2	102.5	102.5
28	100.4	103	101	102	101.4	101.8	102.9	102.5	102	100.5	102	103
29	101	102.8	100.9	101.2	102	101.2	101.9	102	101.5	102.9	101.8	101.4
30	102	102.8	102.8	101.5	102	102.4	103	102	101.5	100.5	103.2	101.5
31	101	102.9	102.5	102	101.5	102.5	101.5	103	102.5	101	103.5	104

TABLE III. Continued

DATE	46		109		58		32		37		86	
1904–1905	a m	p m	a m	p m	a m	p m	a m	p m	a m	p m	a m	p m
February 1	101	101.5	101.5	101.5	102.2	101.9	101.9	102.5	101.9	101.5	102	102.9
2	101	101.5	101.2	102.5	101.5	102	104.5	102	102	102	102	101
3	102.5	102.5	102.5	102.9	101	100.9	101.9	102	102.9	102.5	102	102.9
4	100.9	100.5	101	102	101	101.5	102	102.2	102	100.9	101	102.2
5	102	102.5	101	102.9	101.2	102.9	103	102.5	102	102.5	100.5	101.5
6	101.5	102	102.9	101.5	101.5	101.9	103.1	102	103.5	102	102	100.9
7	100.5	101	101	102	101	102.9	101.5	101.5	101.9	102	102	100.9
8	101.5	101.5	101.5	101.5	102.5	103.2	102.2	102	102	101.5	100.5	102.5
9	101.5	102	102.4	102.2	102	102	102.8	102.5	101.9	103.5	102.4	103
10	101.5	102	101	103.2	101.8	102.5	102	102.5	101	103	103.5	103.9
11	103	102	102	102.2	102	101.5	102	102.5	103	101.5	100.9	102
12	101	101.4	102.5	102	100.5	102.5	103.6	102.3	101.8	101.5	101.4	101.6
13	102	100	101	101	101.5	102.4	102.8	101.2	102.5	100.5	102	100
14	101.5	102.3	101	102.2	102	103.5	101.5	102.9	101.6	102.5	100.2	102.5
15	101.4	101.9	101	102	100.8	102.5	101.4	101.5	101.6	102.5	101.5	102 5
16	100.2	102.5	100.5	101.5	101	102.5	101.8	102	100.3	101.5	101.8	102 5
17	101.9	102.5	101.5	103	102	102.5	101.5	102.6	101.8	102.8	101.5	102 6
18	102.5	102.5	100.6	102.8	104.5	104.5	101.9	101	101.5	102.5	101.5	102.9
19	102	102.5	102	103.2	105	104.5	101.5	102	102	100.5	100.9	101.5
20	102	103	103	102	102.9	104.3	101.5	102.9	101.2	102.2	102	101.8
21	102.5	103	102	102	103.2	105	102	101.9	100.2	102	101.5	102
22	101.5	101.6	102	103	102.6	101.2	102	103.5	101.9	103.8	102	103.2
23	101.5	102	102.5	102.5	102.9	103	102	103.5	102.9	103.2	103.5	102.8
24	100	102.5	102.5	102.5	100.5	102.5	101.5	102.9	102.9	103	101.9	101
25	102.5	103	102.9	103	101.5	102.5	102.9	103	103	103	102.9	103.5
26	101	101.9	102	104	103	102.5	102.5	103.5	102.5	104	102.5	101.5
27	102	103.4	101.5	104	101.4	103	102.5	103.5	102.5	103.5	101	103
28	102.8	102.8	103	103.4	103.8	103.5	102.5	103.5	102.5	103.5	102	102.9
March 1	103	103.8	102	103	102.9	103	102.2	103.5	103	104	102	102.5
2	104	101	103.5	104	102.5	103.4	102.5	105	104.5	104.2	102.5	103
3	100	101.5	102	103.5	102	103.5	102	104	103.5	105	100	102.2
4	101.5	102.9	103	104	101.5	102.9	103	104.2	102	104	101.9	103
5	.....	.....	104	103.5	102	103.5	103.5	105	103.5	104.5	101.5	104.5
6	.....	.....	103	103.9	104	104.5	104.5	104	104.5	105.2	103.5	103.9
7	.....	.....	103.5	103.5	101.5	103	103.2	104.5	103.5	104.8	101.9	102 6
8	.....	.....	102	103.5	104.2	104	101	102	104.2	105	103	103 5
9	.....	.....	101.5	102.3	103	104	102.5	103.4	102	103.5	103	103
10	.....	.....	103	103.5	102	102.5	100.9	102.6	103	103.5	103	103.1
11	..	.....	103.5	103	100.9	101.5	102	101.9	103.5	102.6	101	101.5
12	.....	.....	102.9	103	101.9	102.5	101.5	101.9	102.5	103	101.9	103
13	.....	.....	102.5	103.6	102	102.5	102	103	102.9	102.9	102	101.5
14	.....	.....	102.2	103.5	101.5	103.5	102	103.6	102.5	104	101.5	102.2
15	.....	.....	102.9	104.4	101.2	103.2	103	103.8	102	104.5	101.2	103.5
16	.....	.....	103	105	103	104.2	105	104.5	102.2	104.6	103.2	102
17	.....	.....	103	104.2	101.2	103.9	103	103.6	103.5	104.9	103	103.5
18	.....	.....	102.5	104	102	103.5	101	103.9	102.5	103.9	102	103.5
19	.....	.....	102	103.2	102.5	104	103	103.5	103	104.9	102	103.9
20	.....	.....	102	103.5	101.9	104	102	104	102	104.2	102	103.2
21	.....	.....	102	103	102	103.7	102.9	103	102.5	104.5	102.3	103.5
22	.....	.....	103	102.5	103	104	102.8	104	103	104.9	102.5	103.5
23	.....	.....	102	103.9	103.5	103	102.5	103.9	104	104.5	102.5	103
24	.....	.....	102	102	101.9	104	102.5	104	103.5	105	102.5	103.9
25	.....	.....	102	102.5	103	104	103.5	104	104	104	102.5	102.9
26	.....	.....	101.9	102.9	101.9	104.5	102	103.9	103	104	102	103.5
27	.....	.....	101.5	102.9	101.2	104.5	102.5	103.9	101.5	105	102	104
28	.....	.....	101	102.5	102.9	105.5	102.9	103	102.5	105	103.5	104.5
29	.....	.....	.....	.....	101.5	102.5	.....	.....	104	104.4	101.5	102.2
30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Table of Selected Temperature Records of Inoculated Cattle that Died of Inoculation Fever.

TABLE IV.

DATE		538		649		641		650		648		609	
1907		a m	p m	a m	p m	a m	p m	a m	p m	a m	p m	a m	p m
January	16	100.8	101.2	101	101.2	104	101.4	101	106.3	101	101.2	101.6	101.8
	17	101.2	102	101	101	101	102	102.4	102	101	101	101.6	101.8
	18	104.4	100.6	100.6	101.6	101	101.6	102.4	100.2	101.4	101.6	101	102
	19	101.2	102	101.8	101	100.8	101.4	102.2	101	101.3	101	101.4	100.8
	20	101.6	103	101	101	101	102.4	100.4	102	102	101.4	100.4	101.8
	21	101.6	104	101.8	104	102.4	102.2	102.2	104.2	100.4	101	101.4	102
	22	105	104.8	105	102.2	104.6	105.6	101.8	101	101	101.6	101.8	102.6
	23	101.4	104	102.6	105.8	104.4	102.8	100.4	102.2	101.8	102.2	101.4	102
	24	100	101	105.6	105	104	104.8	101.4	102	103.6	104	101	102.3
	25	102.2	102	104	100	102	105	101.6	101.2	102	102.4	101	102.1
	26	100.4	100.6	99.8	101.8	102	102	101.2	98.4	101.2	103.6	101.8	102
	27	101.6	104	101.2	101	101.6	101.4	102	102.4	101	104	102.2	102
	28	101.6	101	102.2	102.8	101	101.4	100	101.8	103	103.4	101.8	99.3
	29	101.4	100.4	103.4	101.4	102.5	102.6	101.6	99.5	104	105	101.6	101
	30	102	103.8	102	103.4	101	102.4	102	102	102	103.2	101.6	101.4
	31	101.4	102.4	103.4	104	102.2	102	102	104.6	103	101	102.4	103
February	1	102	103	102	103	103	102.2	100.6	102	103	102	102.4	101.8
	2	101.4	103.2	102	101.2	103	104.6	101.6	101.6	101	102.2	102	102
	3	103.8	103.2	102	103	103	101.9	101.2	101.2	101	102.2	102	103
	4	100.6	103	102.2	103	103	103	101	104	101.7	102	102.2	102.4
	5	100	103.2	101.6	102.2	103	102.8	101.2	103.2	101	103	101	102
	6	101	103	103	103	102.8	103	102	102.8	101.2	103.2	102	103
	7	102.2	102.8	102	102.2	103	103.4	103	103	102.1	102.8	101.8	102.2
	8	102.6	104.2	102.4	102	102.2	105.6	101.6	102	102	104	101.8	106.2
	9	103.4	103	103	102	104.3	104.9	101.6	102.3	103	103.9	104	104.2
	10	102.8	102.8	101.2	102.3	103	105.3	102	102.4	101.8	102.5	103	105
	11	101.4	100	102.2	99.4	104	105.4	101	100.2	100.8	100	104.4	105
	12	104	104.6	101.4	102.4	104.6	104.2	101.8	102	101	102.7	103.8	104.2
	13	104.8	104.8	102	101.4	103.2	103.6	101.8	100.8	101	104	99.2	101.6
	14	104.6	103.2	101	101.6	104	105.6	101.8	100.2	104.4	103.8	103	104.6
	15	99	101.8	101.4	102.8	102.8	102.6	102.2	102	100.2	100.8	98.5	99.4
	16	99	.....	101.6	102	102	103.4	101.7	100	101.4	101.2	100	100
	17	.....	.....	102.6	103	104.2	105.6	102	102	101.4	103.6	100	100.5
	18	.....	.....	103.8	104	101.6	102.3	102	101.6	102.6	102	.....	.....
	19	.....	.....	102.6	103.4	104.2	104	103.8	99.1	103	104	.....	.....
	20	.....	.....	102.6	103.4	103.5	104	101.8	.....	102.2	103	.....	.....
	21	.....	.....	102	102.6	104	103.2	.....	.....	103.2	102.2	.....	.....
	22	.....	.....	103	105.4	104	103.8	.....	.....	103.6	104.5	.....	.....
	23	.....	.....	98	101.8	104	105.6	.....	.....	103.4	102.3	.....	.....
	24	.....	.....	102	105	102	105.6	.....	.....	101	101	.....	.....
	25	.....	.....	102	105.4	98.5	104.6	.....	.....	100.2	100.6	.....	.....
	26	.....	.....	99	102	101	105	.....	.....	.....	.....	.....	.....
	27	.....	.....	100.2	104	102	103.6	.....	.....	.....	.....	.....	.....
	28	.....	.....	101	102.4	100.8	101.3	.....	.....	.....	.....	.....	.....
	29	.....	.....	101	.....	100	102	.....	.....	.....	.....	.....	.....
March	1	.....	.....	.....	.....	100	101.4	.....	.....	.....	.....	.....	.....
	2	.....	.....	.....	.....	99.4	101	.....	.....	.....	.....	.....	.....
	3	.....	.....	.....	.....	102	100	.....	.....	.....	.....	.....	.....
	4	.....	.....	.....	.....	98	99	.....	.....	.....	.....	.....	.....
	5	.....	.....	.....	.....	98.5	98	.....	.....	.....	.....	.....	.....
	6	.....	.....	.....	.....	98.8	.....	.....	.....	.....	.....	.....	.....
	7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE IV. *Selected Records of 15 Deaths from Inoculation*

Number of the Animal	Days after 1st Inoculation Died	Days af er 2nd Inoculotion Died	Highest Temperature	Lowest Temperature	Age, Breed, Condition of Animals, Etc.
691	13		107.4	97.8	Grade Jersey
611		22	105.6	99.8	
607	11		107.2	100.6	
649	46		105.8	98.	
580	17		106.8	96.	
655	18		107.2	99.8	
650	37		104.6	98.4	Very fat Gurnsey 12 yrs. old
648	41		105	100.	Very old cow
609	35		106.2	98.5	Jersey cow, 9 yrs. old
646	13		106.4	100.	
623	18		106.8	100.4	Holstein cow, 8 yrs. old
658	13		107.2	103.	Short Horn cow
654		9	107.	100.	Short Horn cow, 4 yrs. old
538	33		104.8	99.	Grade Holstein cow, 7 yrs. old
644	52		105.6	98	Grade Gurnsey cow, 8 yrs. old

This table shows that a small number die after the second inocululation and that the temperature falls to sub-normal just before death.

The following descriptions of eight kinds of ticks were compiled by Mohler from Salmon and Stiles' work on "The Cattle Tick" and these and Figs. 1, 2, 3 and 4 are taken from Farmers' Bulletin No. 258 of the Bureau of Animal Industry, Department of Agriculture, Washington, D. C.

TEXAS FEVER, OR CATTLE, TICK (*Boophilus annulatus.*) —Figure 3, No. 1a, shows the natural size of an adult female Texas-fever tick, whose characteristic markings are better brought out in No. 1, magnified four times.*a* This tick may be readily distinguished from the other seven ticks by the small size and the color of the head and shield, the so-called head parts, whose lateral borders are straighter and more parallel, as shown in No. 1b. These head parts are short and relatively broad and dark reddish brown or chestnut brown in color, appearing as a convex plate on the median line at the fore end of the

a In figures 3 and 4 various ticks that infest cattle are shown as follows: The natural sized nature female tick, this tick mangnified four times, and the head and shield of the same enlarged ten to fifteen times.

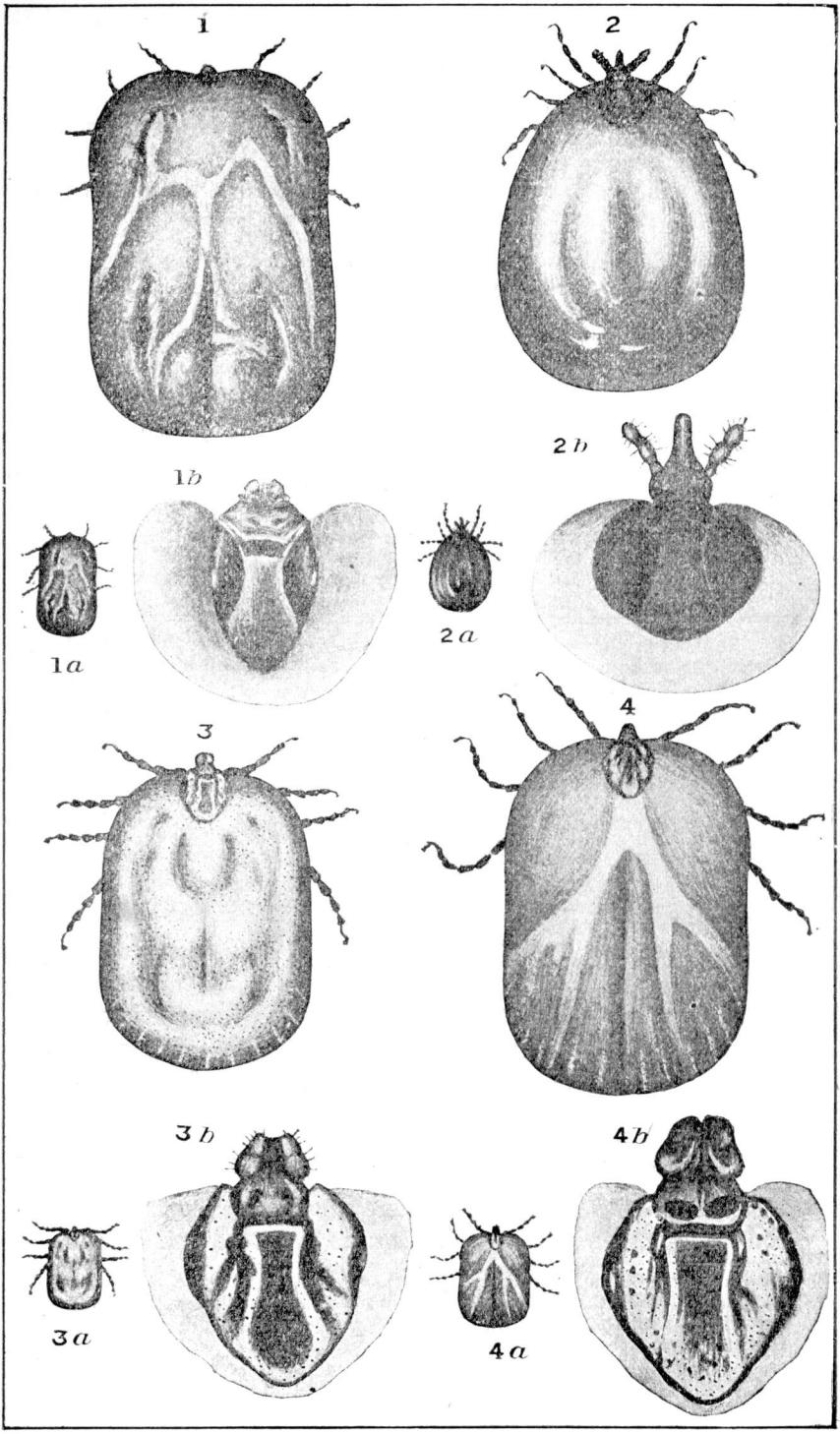


FIG. 3.—Various ticks that infect cattle

tick. The body is oblong oval in shape and may reach one-half inch in length. The color varies from a dull yellow to an olive brown; often it is mottled with irregular areas of yellow and brown or streaked with wavy lines of these colors. Two grooves or indentations are seen running from the front to the rear on the skin of the back, which become almost, if not entirely effaced at about the middle of the body. Another groove is seen between these two grooves in the posterior half of the body. These grooves are caused by the contraction of the muscles of the body and therefore vary considerably, entirely disappearing when the tick is full of blood. They are very distinct when the ticks have been removed from cattle several days. The four pairs of legs are brown, moderately long, and very slender. This tick is found principally on cattle, less frequently on horses, mules, and asses, and in one case it was found on a deer. The Federal quarantine line indicates the northern boundary of the section of the United States infested with fever ticks.

CASTOR-BEAN TICK (*Ixodes ricinus.*)—The body of this tick (fig. 3, Nos. 2 and 2a) resembles in shape that of an eggplant, and it takes its name from its similarity to the bean of the castor-oil plant. It is lead colored, with a variegated mixture of yellowish red, brown, or gray. The body contains two anterior grooves that slightly diverge from each other, and three posterior grooves, the middle one of which is straight, while the other two are curved outward. The mature female is from three-eighths to seven-sixteenths inch long and has four pairs of dark-brown thin legs. The head and adjacent shield are a shiny dark brown or a chestnut brown, the latter portion being five-sided, like a pentagon (No. 2b), with lateral borders prominent and rear angle rounded. Two stout and well-developed feelers (palpi) may be seen extending outward on each side of the head. This tick has been collected from sheep, cattle, goats, horses, deer, dogs, cats, foxes, rabbits, birds, man, and a few other animals.

It was one of the first ticks studied, and has a very wide distribution in the United States.

NET TICK (*Dermacentor reticulatus.*)—The body of the adult female tick is oblong oval, five-eighths inch long, and of a deep brown or slate color (fig. 3, Nos. 3 and 3a). It has four pairs of brown legs of moderate length. The skin of the back and head is covered with fine points, or punctations, which almost disappear at this stage. Besides the grooves that are located like those in the cattle tick, there is a marginal groove extending around the body just inside the border. There are also eleven small indentations (festoons) arranged about the posterior margin of the body. These festoons and grooves become shallow or effaced in the adult stage. The shield portion of the head parts has a silvery white metallic rust extending along the two sides and posterior portion (No. 3b). It may have a rose or greenish tinge. The head is larger than that of the cattle tick. The net tick has been found on man, cattle, horses, sheep, and deer; and in this country it seems to be most common in the West, especially in California, Texas, and New Mexico.

AMERICAN DOG TICK; ALSO CALLED WOOD TICK (*Dermacentor electus*).—This tick (fig. 3, Nos. 4 and 4a), resembles the net tick (*Dermacentor reticulatus*) so closely that a hand lens must be used to distinguish between them. However, it can be readily known from the Texas fever tick by the fact that the so-called head parts are longer and broader (No. 4b). Here there is also a yellowish white rust in the posterior portion which extends anteriorly along each side as two bright, iridescent lines separated by a central brownish area. The body is oblong oval in shape and measures as much as three-fifths inch in length. The skin of the back contains grooves like those found in cattle ticks, and, in addition, another groove extending around just inside the margin, together with eleven smaller grooves (festoons) on the posterior border. These lines, so distinct in the young female, become shallow at maturity. This tick has been found on

man, cattle, dogs, horses, rabbits, and panthers, and has been collected in woods and on uncultivated lands in many sections of this country, especially in eastern United States.

LONE STAR TICK (*Amblyomma americanum*).—As indicated by Nos. 5 and 5a of figure 4, the body of this tick is oblong oval and of a yellowish gray or brown color. The skin is rough and puckered unless the body is full of blood. The reddish brown area at the front of the tick is composed of the head and head shield. The latter extends backward a short distance to form a triangle, in the apex of which is a white or metallic-yellow spot from which it derives its name "Lone Star" (No. 5b). The mature female may reach one-half inch in length and has four pairs of long thin legs. This tick has been found on cattle, dogs, horses, sheep, goats, hogs, and man, and is very widely distributed in the United States.

EAR TICK (*Ornithodoros megnini*).—As will be observed from Nos. 6 and 6a, figure 4, the shape of this tick is similar to that of the body of a violin. It is nearly twice as long as broad, rounded at both ends, narrower behind than in front, and slightly constricted in the middle. In color it varies from gray or brown to violet, and has two grooves behind the head, with a middle one in the posterior portion. On the skin of the back are numerous minute spines, or stiff hairs. The adult females are from one-fourth to three-eighths inch in length, and have four pairs of long stout legs. The anterior portion of the tick is curved downward to form a cover for the very small and short head, which can only be seen from the under side of the tick. The feelers (palpi) and beak, however, stick out from under the front part of the body and can be seen from above (No. 6b). This tick is found in the ears of cattle, horses, mules, asses, and other animals in the South and West.

CHICKEN TICK (*Argas miniatus*).—In shape and appearance this tick is like an enlarged bedbug, and is of a uniform reddish brown color, with four pairs of lighter

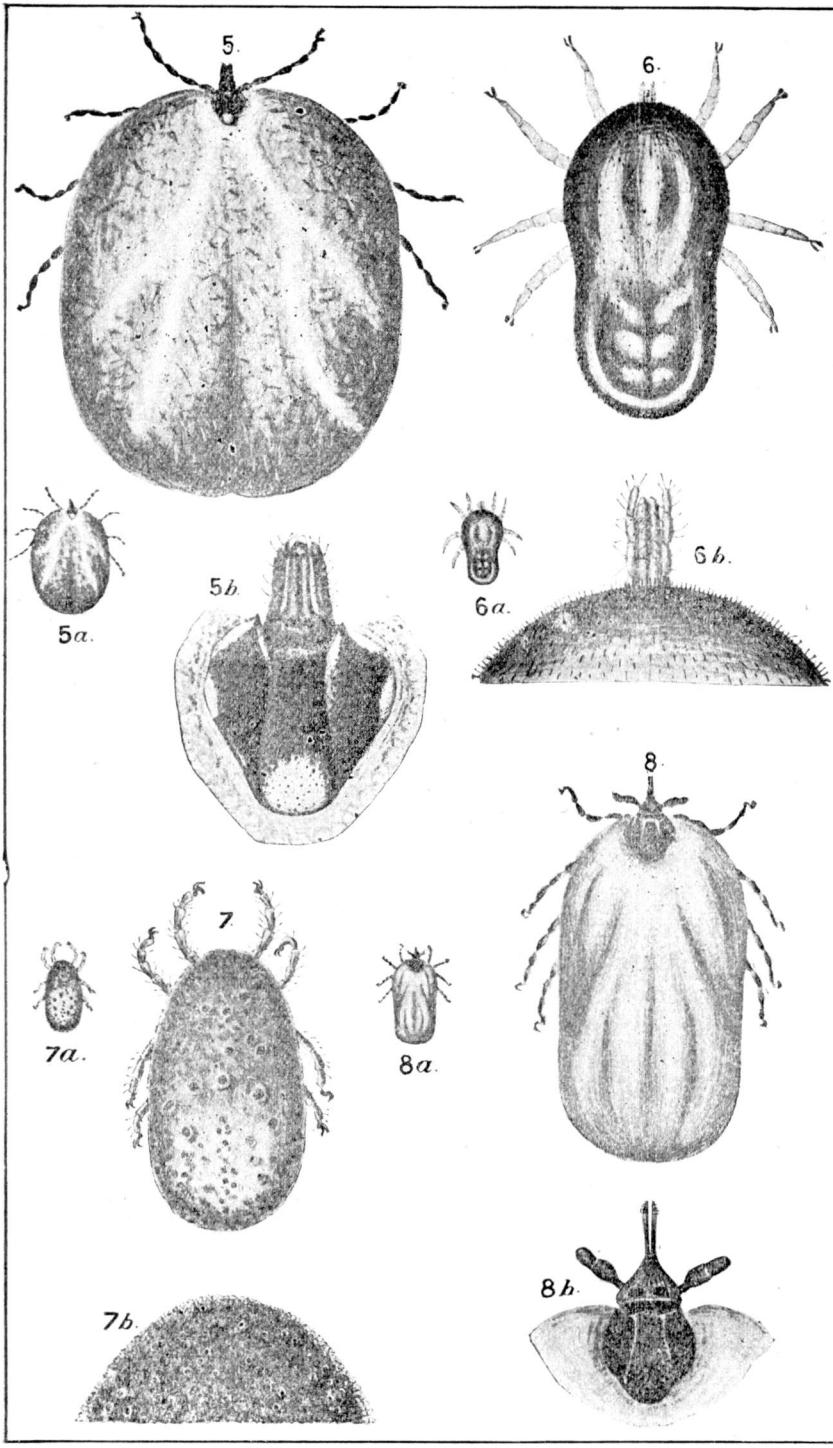


FIG. 4.—Various ticks that infect cattle

colored legs. The skin is wrinkled and contains very short and minute hairs. On the top as well as the bottom of the tick are numerous bright pits or cavities with raised borders (fig. 4, Nos. 7 and 7a). These vary in size, are arranged in rows radiating from the center more or less uniformly, and are usually symmetrical on each side. It is about three-eighths inch in size when mature. The head is so completely covered by the body that it can not be seen from the back (No. 7b). This tick has been observed on cattle once only, but is frequently found on chickens, turkeys, and other birds in the South.

EUROPEAN DOG TICK (*Ixodes hexagonus*).—The body of this tick is oval in shape and of an ashy color (fig. 4, Nos. 8 and 8a). The grooves on the back are united in an arch in front and diverge in the posterior portion of the body. The four pairs of legs are longer, thicker, and stronger than those of the cattle tick. The head and shield are brown-red in color and similar in shape to those of the catsor-bean tick, but less oval and rather more lozenge-shaped, with more acute lateral angles and narrower posterior angle (No. 8a). The palpi, or feelers, are longer and more prominent than in the cattle tick, but not so long as in the castor-bean tick. This dog tick has been collected from dogs, cattle, sheep, foxes, rabbits, squirrels, gophers, cats, birds, man, and other hosts in eastern United States.

LIFE HISTORY AS OBSERVED IN ALABAMA.

The following cattle tick records were made by Mr. W. M. Lewallen, while a student at Auburn, Ala., from August, 1905, to August, 1906. The fall of 1905 was dry, the winter was average with alternate periods of cold and warm weather. The spring of 1906 was early and average in moist and dry spells, and the summer was hot and wet.

Out of 20 ticks that began to lay from August 11 to 19 the number of days between laying and hatching were as follows: 30, 29, 23, 24, 23, 23, 23, 24, 25, 25, 25, 25, 25, 25, 26, 27, 27, 25 days—an average of 25 days.

The ticks were all dead as follows: 35, 35, 35, 35, 35, 35, 35, 36, 35 days, an average of about 35 days and including the progeny of half the ticks. Of the other half after 35 days the progeny of two ticks were all alive and active, and after 35 days the progeny of the remaining ticks were nearly all dead.

In another lot of four ticks that began to lay September 19 to 21, hatching began after 40, 48, 42, and 46 days or an average of about 45 days. After 122 days and 228 days the progency of two ticks were all dead. After 63 days the progeny of one tick were alive, but inactive.

Tick Egg-Laying Record for 1905-1906.

DATES	DAYS	EGGS-LAID
From Oct. 31, 1905 to Feb. 12, 1906	104	3016
From Nov. 27, 1905 to Feb. 12, 1906	97	1632
From Jan. 21, 1906 to Mar. 15, 1906	53	1141
From Jan. 22, 1906 to Apr. 6, 1906	74	1487
From Jan. 22, 1906 to Mar. 19, 1906	56	1694
From Jan. 21, 1906 to Apr. 23, 1906	92	3840
From Jan. 21, 1906 to Apr. 19, 1906	88	3101
From Jan. 21, 1906 to Apr. 23, 1906	92	2840
From Feb. 15, 1906 to Apr. 6, 1906	50	1013
From Mar. 3, 1906 to May 3, 1906	61	2981
From Feb. 12. 1906 to Apr. 26, 1906	73	3586
From Feb. 23, 1906 to Apr. 28, 1906	65	2388
From Apr. 5, 1906 to Apr. 28, 1906	23	3687
From Apr. 7, 1906 to Apr. 26, 1906	19	2987
From Apr. 5, 1906 to Apr. 30, 1906	25	3210
From Apr. 5, 1906 to Apr. 27, 1906	22	1858
From Apr. 6, 1906 to May 1, 1906	25	2724
From Apr. 3, 1906 to May 1, 1906	28	3132
From Apr. 6, 1906 to Apr. 8, 1906	2	137
From Apr. 3, 1906 to May 1. 1906	28	3003
From Apr. 15, 1906 to May 5, 1906	20	1446
From Apr. 3, 1906 to May 2, 1906	29	2175
From Apr. 23, 1906 to May 9, 1906	16	3496
From Apr. 23, 1906 to May 18, 1906	25	2862
From Apr. 25, 1906 to May 7, 1906	12	1372
From Apr. 26, 1906 to May 7, 1906	11	345
From Apr. 26, 1906 to May 2, 1906	6	164
From May 21, 1906 to June 14, 1906	24	2687
From May 21, 1906 to June 4, 1906	14	1940
From June 18, 1906 to July 8, 1906	20	4261
From June 18, 1906 to July 4, 1906	14	4191
From July 16, 1906 to Aug. 8, 1906	23	3475
From July 16, 1906 to Aug. 12, 1906	27	3947

Monthly Average Egg Record for 1905-1906.

First Egg Laid	No Ticks	Last Egg Laid	Average No. Days	Average No. Eggs
From Oct. 31, 1906	2	Feb. 12, 1905	100	2324
From Jan. 21, 1906	6	Apr. 19, 1906	76	2350
From Feb. 12, 1606	4	May 3, 1906	62	2492
From Apr. 3, 1905	10	May 2, 1906	22	2435
From Apr. 23, 1906	5	May 18, 1906	14	1648
From May 21, 1906	2	June 14, 1906	19	2313
From June 18, 1906	2	July 8, 1906	17	4176
From June 16, 1906	2	Aug. 12, 1906	25	3711

Tick Record on Horned Jersey Calf, Texas Ticks

Oct. 15. 1905 Infested with 15 ticks.
Oct. 19 or 20. Moulted first time.
Oct. 21 or 22. Dark brown color; size of pin head
Oct. 28 or 29. Moulted second time, grew slowly up till this time. Ticks were brushed off (?) calf at this time before maturing.

On Hornless Jersey.

Nov. 15. Infested with 15 ticks.
Nov. 18. Ticks found on inside of thigh.
Nov. 20. Ticks lead white.
Nov. 21. Ticks darker, nearly brown.
Nov. 24. (1) Tick has reddish thorax, abdomen color of oxide of lead.
(2) Other ticks are milk white in color.
Nov. 27. (2) Tick has yellowishstripe on back.
Nov. 28. (1) Tick has yellowish specks on back.
Nov. 30. (2) Tick moulted. (1) Tick has yellowish spots on back.
Dec. 1. (2) Tick became dislodged leaving his moult on cow (1) Tick moulted.
Dec. 5. (3) Tick found.
Dec. 6. (3) Tick dislodged. Ticks cannot be found.

Jersey Calf Below Barn.

Nov. 15. Infested with 15 ticks.
Nov. 20. Ticks lead white.
Nov. 28. Ticks grew larger.
Nov. 30. (1) Tick has yellowish stripe on back.
Dec. 1. 1, 2, 3, 4 appear about ready to moult; (5) tick has moulted.
Dec. 2. (2) Tick moulted (3) Tick has white speck on belly.
Dec. 3. 1, 3, 4 Ticks moulted

Dec. 6. (4) Tick has tick beneath it (male?) about ½ its size.
(5) Tick missing.

Dec. 9. One female tick has two small male ticks beneath her; when she was lifted they seemed to be attached to her and on separation a little blood was present at the attachment. Female lead color, males brown.

Dec. 9. Another female like the above with only one male
Males don't increase in size while females grow rapidly.

Dec. 13. Dropped off of calf.
Total no of days on calf **28**
One tick moulted in 15 days (2nd moulting). Others in 16 and 17 days.

Red Spotted Calf

Dec. 15. Infected calf with 15 ticks. Auburn ticks.

Dec. 19. (1) Tick found, lead color.

Dec. 21. 1. Moulted and changed position.

Dec. 25. 2. Tick discovered, has white speck on abdomen

Dec. 31. 1. Tick of white cast, about size of pin head.
2. Tick in process of moulting. Seems to have loose skin.

Jan. 1. 06 2. Tick has mark on back. 1. Tick whitish skin on belly.

Jan. 3. Removed moult from both ticks, about size of tack head, dark brown.

Jan. 5. 2. Tick disappeared, Removed moult from tick 3. Tick 4. getting ready to moult. Tick 5. much smaller.

Jan. 6. 3. Tick moulted again, larger than yesterday.

Jan. 7. 6. Tick has one beneath it when discovered to-day.

Jan. 8. 6. Tick has no tick beneath it

Jan. 10. 4, 6&7, have males beneath them; females 6&7 about four times size of males with partial moult on posterior half of body.
5. Tick moulted.

Jan. 12. 6&7 detached; 7. grown yesterday; 6. removed to-day.
5. Tick has yellowish marking on back, males of 6&7 still attached.

Jan. 13. 5. Tick changed location; 4. Tick removed moult; males of 6&7 have disappeared, leaving bloody seat. Found 2 females on abdomen about grown, removed them. 3. Tick moulted.

Jan. 14. 4. Tick light brown, male left it, not ready for fertilization as she moulted after male sought her.

3. Tick has 2 males beneath her.

Jan. 16. 4. Tick had a male beneath her. Only one male under tick 3.

Jan. 18. 3. Tick engorged removed for breeding male left on calf.

Jan. 19. Male of tick 3 gone.

Jan. 23. 4. Tick engorged removed.

Jan. 24. Found two more engorged females, left them to see how long they remain.

Jan. 25. Two ticks found yesterday have dropped. Another found but disappeared.

Tick 4 engorged in 39 days removed by hand.

Tick 3 engorged in 34 days removed by hand.

Tick 1 moulted in 6 days.

Removed moult from 1&2 in 19 days.

Removed moult from 3 in 21 days.

Tick 5 moulted in 26 days.

Jersey with Horns.

Jan. 15. Infested with 15 ticks.

Jan. 16. 1 tick found.

Jan. 19. 1 tick again found, white spot on posterior part, probably moulted 18th.

Jan. 27. No ticks found from 19 to 27.

Jan. 30 Found a tick size of pin head, lead color.

Feb. 2. Tick oval shape, has yellow stripes on back.

Feb. 4. Tick moulted.

Feb. 9. Dark brown color.

Feb, 13. Tick mated.

Feb. 13. 2 ticks found ready to begin 2nd monlting.

Feb. 14. 1. tick dislodged.

Feb. 15. Male of 1 tick still attached.

Feb. 16. Male of 1 tick gone, 2 tick m ulted.

Feb. 29. 2 tick dislodged.

Mar. 8. 2 tick couldn't be found.

Ticks collected on Jauuary 15 began to deposit eggs March 12 and continued during a period on an average of 40 days. Ticks collected on April 15 began to deposit eggs April 25 and continued during a period of an average of 17 days. The average length of life of ticks on cattle for late summer and early autumn was 22 days for three tests. Longevity of larvae during the late fall and winter was six months and during the summer and autum thirteen days. The average length of parasitic period for five ticks during the latter part of summer, autumn, winter and early spring was twenty-nine days, the longer period prevailing in winter.

The following records were made by C. T Butler, while a student assistant in the Veterinary Department, during 1906 and 1907.

Bottle No.	Date Laid	Date Hatched	Percent Hatched (Approximate)	When dead and Remarks
All	Aug. 20-Sept. 20, '06	Began Sept. 19, '06		One bottle dead Oct. 15; another Oct. 20, due to lack of moisture (?). In the other bottles many ticks dead Mar. 20, 1907. Ticks dead in all but one bottle Mar. 28; in this boltie about half dead. Apr. 3, few ticks alive, but dead Apr. 10, 1907.
1	Sept. 20-Oct. 4, '06	Nov. 19-22, 1906	100	All dead but few Mar. 28; dead Apr. 1, 1907.
2	Sept. 20-Oct. 5, '06	Nov. 19-22, 1906	100	Many dead Mar. 28; all dead May 5, 1907.
3	Sept. 20-Oct. 27, '06	Nov. 19-22, 1906	100	All dead Mar. 28, (lack of moisture) (?)
4	Sept. 20-Oct. 29, '06	Nov. 15-22, 1906	100	All dead but few Mar. 28, '07. All dead Apr. 1, 1907.
5	Sept. 20-Oct. 1, '06	Nov. 19-22, 1906	100	All dead Mar. 28; due to lack of moisture (?).
1	Oct. 22-Nov. 22. '06	Began 3-10, 1907	10 to 20	Few ticks dead Apr. 12, '07
2	Oct. 22-Nov. 58, '06	Began 3-10, 1907	10 to 20	Few ticks dead Apr. 12, '07
3	Oct. 23-Nov. 9, '06	Began 3-5, 1907	5 to 10	4 to 10 ticks living Apr. 28, most of ticks died soon after hatching.
4	Oct. 22-Nov. 12, '06	Began 3-5, 1907	10 to 20	4 to 10 ticks living Apr. 29, dead May 22, most died early.
5	Oct. 22-Nov. 12, '06	Began 3-5, 1907	10 to 20	More than half dead Apr. 29, 1907.
1'	Nov. 22-Dec. 18, '06	Began 4-3, 1907	1 to 5	Most of Eggs shrivled; few dead Apr. 29.
2	Nov. 21-Dec. 18, ,06	Did not hatch	0	Possibly too much light.
3	Nov 21-Jan. 16, '07	Began 4-3, 1907	not over 5	Few dead May 23.
4	Nov. 22-Dec. 18, '06	Began 4-3, 1907	5 to 10	Few dead Apr. 29.
5	Nov. 24-Dec. 18, '06	Began 4-3, 1907	10 to 15	Nearly all dead May 23.
1	Jan. 7-Feb, 5, '07	2 hatched Apr. 29	0	Egg shriveled.
1	Jan. 18-Mar. 5, '07		0	Eggs shriveled
2	Jan. 19-Mar. 26, '07		0	Probably due to too much light.
3	Jan. 19-Mar. 2, '07	1 tick but dead		
1	Mar. 2-25, 1907	May 10-23	30 to 50	
2	Mar. 3-26, 1907	May 6-23	70 to 90	
3	Mar. 4-30, 1907	May 10-23	30 to 40	
4	Mar. 5-26, 1907	May 10-23	40 to 60	
5	Mar. 5-25, 1907	May 6-23	80 to 90	
1	Mar. 22-Apr. 1, '07	May 22		
2	Mar. 23-Apr. 26, '07			
	Mar. 27-Apr. 9, '07			

Of the ticks that hatched Nov. 1906, bottle 2 lived until May 1907, others died some time before probably due to lack of moisture.

The probable reason for eggs (laid between Oct. and Mar.) being shriveled is too much light. Direct rays of the sun was sometimes on them, for 2 hours per day.

Summary of Butler's Tick Records.

Aug. 20.-Sept. 10. 6 ticks laid from 305-3,456 eggs.....Ave 1,623
Laying period from 18-22 days.....Ave. 20 days
Sept. 20-Oct. 5. 5 ticks laid from 1,056-2,243 eggs.....Ave. 1,520
Laying period from 8-10 days.....Ave. 12 days
Oct. 22-Nov. 28. 5 ticks laid from 1,125-2,646 eggs.....Ave. 1,703
Laying period from 18-37 days.....Ave. 25 days
Nov. 21-Jan. 16. 5 ticks laid from 2,235-2,937 eggs.....Ave. 2,599
Laying period from 27-56.....Ave. 33 days
Jan. 4-Feb. 5. 1 tick laid 1,978 eggs 1,978
Laying period, 29 days.....29 days
Jan. 18-Mar. 5. 3 ticks laid 833-1,721 eggs.....Ave. 1,192
Laying period, from 26-46 days.....Ave. 39 days
Mar. 2-30. 5 ticks laid 1,419-3,413 eggs.....Ave. 2,414
Laying period, 23-28 days.....Ave. 24 days
Mar. 22-Apr. 26. 3 ticks laid from 340-3,745 eggs.....Ave. 1,371
Laying period from 9-34 days.....Ave. 20 days
N. B.—Tick 3 was only half-grown eggs; did not hatch.
Apr. 25-May 20. 5 ticks laid from 1,143-3,703 eggs.....Ave. 2,656
Laying period from 8-25 days.....Ave. 20 days

Summary of Non-Parasitic Life of Tick

Egg-laying period	Average no days	Hatching period	Longevity of Seed Tick
Aug. 20-Sept. 10	20	30 days	A few lived 190 days
Sept. 20-Oct. 5	12	29 days	Few lived for 129 days
Oct. 21-Nov. 28	25	131 days	Few lived for 50 days
Nov. 21-Jan. 16	33	131 days	All dead in 58 days
Jan. 18 Mch 5	39	no hatching	
Mch. 2-Mch 30	24	64 days	No record
Mch 22-Apr. 26	20	60 days	No record
Apr. 25-May 20	20		

The winter of 1906 and 1907 was exceptionally warm. The mature laying ticks, eggs and seed ticks were kept in a room with window open and no fire in the room. The seed ticks and eggs were kept in test tubes with moist cotton in the lower part of the tubes.

WHY ERADICATE THE CATTLE TICK.

The cattle tick lives by drawing the blood from its host, and the host is usually cattle. When undisturbed, the ticks in a pasture get so numerous that they take sufficient blood from the cattle in the pasture, to reduce or retard the growth of the cattle, or check milk or beef production. I have seen cattle go into a tick infested pasture in fairly good condition in the spring and owing to loss of blood by ticks and the tick fever, the cattle came out of the pasture in the fall weighing less and consequently much poorer than when they went into said pasture, and the pasture a good one so far as the grass and water supply were concerned.

Tick fever kills more native cattle in the tick infested areas than all other cattle diseases in the South. Moreover, the cattle tick prevents free trade in the markets of the United States and of the world for the greater part of the year. Consequently, it decreases the market price of southern fed and southern bred cattle from one-fourth to one-half a cent per pound in the cattle markets above the quarantine line.

The losses from death of northern cattle and imported cattle brought into the South have been so great that improvement in the various dairy and beef breeds represented in the South and the introduction of new breeds of cattle have been seriously hindered and checked.

The following tabulated statement will give an approximate idea of the various losses falling upon the tick infested area of the South:

Number and Value of Farm Animals in Alabama Jan. 1, 1906.

Animals	No.	Farm Value	Total Value of Each Kind	Total Value of all Animals in Ala., Jan. 1, 1906
Cows	253,132	$ 20 40	$ 5,163,893	
Other cattle	496,762	8 32	4,131,822	
Horses	155,142	93 69	14,535,227	
Mules	185,839	111 66	20,750,794	
Swine	1,137,501	4 65	5,289,380	
Sheep	195,597	2 10	409,776	
				$50,280,892

In the United States Jan. 1, 1906, there were about 67,000,000 cattle. In the entire quarantined area there were about 15,000,000 cattle. In Alabama at the same time there were 749,894 cattle. Losses coming directly and indirectly from the cattle tick:

1. Decrease from milk production in five million milk cows, one million of which is giving milk all the year. Each cow in milk losing one quart of milk per day and rating that at four cents per quart on the farm.
1,000,000 x .04 equals $40,000 per day.
$40,000 x 365 gives the loss per year $14,600,000

2. Loss in the decreased or checked or retarded growth in the other 14,000,000 cattle at $1 per head 14,000,000

3. Loss of at least $3 per head on all cattle from the South sold above the quarantine line—700,000 cattle at $3 each 2,100,000

4. Loss by death from tick fever of 700,000 native cattle each year, valued at $15 per head 10,500,000

5. Loss by tick fever of breeding cattle shipped from the North into the South 50,000

6. Cost of the United States and the various quarantined States in maintaining quarantined lines and eradicating the tick 200,000

Total annual loss from the cattle tick in the quarantined area $41,450,000

Alabama loses each year about one-twentieth of this total or about $2,000,000. The total live stock valuation

for Alabama is $50,280,892. Hence, the cattle ticks in Alabama produce a loss of 4 per cent. each year on the amount or capital invested in live stock.

METHODS OF ERADICATING CATTLE TICKS.

I. CLEANING CATTLE.

1. By applying oils to the cattle. This may be employed by using hand cloths or swabs, by spray pumps or by dipping the cattle in a vat or in a dipping tank. The oils that can be used are more or less variable. Beaumont crude petroleum, West Virginia or Kentucky Black oil, cotton seed oil, lard, machine oil, etc., have been employed. Kerosene oil (20 to 25 per cent.) emulsion or kerosene oil (20 to 25 per cent.) in combination with cotton seed oil or with lard have been used. One to two per cent. of sulphur may be added to any of the above oils except Beaumont oil or black oil. The essential things in the use of oils or grease in killing ticks on cattle is to be certain to apply it all over the cattle. If many cattle are to be treated use a spray pump or a dipping tank. (a) If a few cattle are to be greased, a good piece of sacking burlap or cotton bagging may be employed by hand or on a swab stick. Have the animal put into a specially prepared break or chute. Two men (one working on each side of an animal) can grease five to ten cattle in an hour. (b) A spray pump, costing five to fifteen dollars, is very convenient. The bucket spray pump is the cheapest. But the knapsack and the barrel spray pump are very handy. These pumps are the same as horticulturists use in spraying fruit trees. It is well to have a kerosene mechanical mixer attached to pump. With it you can use water or kerosene with the oil. This pump will mix twenty-five per cent. of Beaumont oil with the water and effectually cover the cattle with very little loss of oil. The water possesses no advantage except to spread the oil in thinner layers, to make it go farther and waste less. A quart of Beaumont oil will effectually cover a 700 pound cow with this mechanical mixer spray pump;

while it will take two to four quarts to cover the same cow in putting it on with a hand rag or swab or by immersing her in a dipping vat filled with oil. Two sprayers, one working on each side of the animal, will spray one to two hundred cattle in a day. (c) Oil in the dipping tank or vat is rather expensive. But is is sometimes employed in that way—especially by the Federal government and by the large ranch owners in Texas. In order to fill a 2,000 gallon dipping tank it would take a half car load of Beaumont oil. Some have tried it by having about six inches of oil floating on water in the tank. This has not in all cases proven successful. The Beaumont oil may be used in the tank in a 25 per cent. soap emulsion.

Oil has some striking advantages. It destroys ticks, it stays on the hair and skin for several days, it keeps off flies. It prevents skin evaporation and consequently may raise the animal's temperature; to avoid this danger have plenty of shade and water for the cattle for one or two days after oiling them.

2. An arsenical dip has been employed successfully in Cuba, Texas and in one instance in Alabama. Dr. N. S. Mayo, chief veterinarian of Cuba, first used this formula and directions for making it are as follows:

Arsenic trioxid, commercial	8 pounds.
Sodium carbonate, crystalized	24 pounds.
Yellow soap	24 pounds.
Pine tar	1 gallon.
Water sufficient to make	500 gallons.

Dissolve the arsenic in 20 to 30 gallons of water by boiling 30 to 40 minutes. Add water to make 100 gallons. Dissolve the soda in 20 to 30 gallons of water; dissolve the soap (shaved) in the soda solution; pour the tar into this in a fine stream, stirring at the same time. Mix the two solutions. Add enough water to make 500 gallons.

Dr. John W. Parker, of Texas, made it by leaving out the soap, according to the following formula:

Arsenic	8 pounds.
Sodium Carbonate	24 pounds.
Tar	1 gallon.
Water sufficient to make	500 gallons.

This is made in the same way as given in the directions for preparing Dr. Mayo's dip except the soap is omitted. It is best to use free-stone or rain water in making this dip, also exercise great care in having the ingredients accurately weighed and measured.

The cattle should not be held over one minute in the tank. In fact, it is best not to hold the animal in the tank but let it pass at once through and out of the tank to the dripping pen. From the dripping pen let the animal pass into a bare lot or place containing shade and no grass or feed and remain there till dry.

To dispose of the waste or unused part of the dip, care must be taken. Dig a deep pit in some out of the way place where it will not seep into a well. Put the old unused or waste dip into this pit and cover it with plenty of soil. Remember this dip is poisonous. When through dipping, mark the height of the dip in the tank, then if some of the water evaporates before the dip is used again sufficient water may be added to fill the tank up to mark. Or cover the tank when not in use with close fitting lids or cloth to prevent evaporation and filling with rain water. As a rule it is uncertain and often unsafe to use old arsenical dip. Better carefully dispose of the old dip and prepare a new lot just before using it.

This arsenical dip may be used with a spray pump or by a hand swab. Keep your hands greased with lard or vasaline to prevent the arsenic from injuring the skin, or keep your hands out of the arsenical dip.

3. Cresol dips or coal tar dips or insecticides may be employed by hand or in spray pump or in vat. But many of them are so inconstant in strength that one can not always depend upon them for efficient work. I have known

some that were said to kill ticks when used at a strength of 5 per cent. and a trial proved that a 10 per cent. solution was required to do effective work.

4. Picking cattle ticks from cattle may be employed where one or even a dozen dairy cows are stabled twice a day. The big ticks may be hand picked, or rubbed off with stiff brush or curry comb. The ticks that are picked or brushed off should be given to chickens or otherwise destroyed to prevent them from laying eggs and producing more seed ticks. This must be done once every day. Chickens about a cow lot or yard will pick up all the ticks that drop off and pick a large number of ticks directly from the cattle. Begin this picking early in the spring, because every tick killed in the spring means the cutting off of the seed that will multiply into the thousands in the summer and fall. Another good time to begin picking ticks is September 1, and keep it up until January 1 or until ticks disappear, then keep a good keen eye for ticks again the next spring. In fact picking off the big ticks when oiling or applying any tickicide is wise because some half grown and some mature ticks may escape the oil or the other material; fall to the ground and lay eggs.

Feeding sulphur to cattle will not kill the ticks on the cattle or prevent seed ticks from getting on the cattle. The United States Bureau of Animal Industry and other investigators have thoroughly tested the feeding of sulphur to cattle and proven it to be of no value.

Cleaning Cattle of Ticks Without the Use of Tickicides by Morgans Feed Lot Method, or the Pasture Rotation Method.

1. The feed lot method was first employed by Morgan. In this the cattle are placed in a feeding pen that has been constructed on tick free ground (plowed ground, cotton or corn or sweet potato ground or any place where cattle have not been penned or left for six months or more, is free of cattle ticks). Keep the ticky cattle in this feed

lot for twenty days—say begin May 1 or any time in spring, summer or fall. At the end of twenty days move move the cattle into another cattle-tight feed pen on tick free ground; pen number two should be at least ten feet away from th first pen; keep the cattle all the time in pen number two, for twenty days, and then move them into pen number three of the same kind. As a rule when the cattle move from pen number two into pen number three, the cattle will be entirely free of ticks, no matter how many they had on them in the beginning or when they went into pen number one. This is explained by the life history of the cattle tick. All female ticks when engorged with blood drop off the cattle, hide and soon begin to lay eggs. The tick eggs can not be deposited by the old female tick and then hatch under twenty days. Hence, before any tick eggs hatch or before the appearance of seed ticks in pen number one, the cattle are moved into pen number two. The same is true in pen number two. By the end of forty days in spring, summer or fall all of the female ticks have developed or become mature and have dropped off the cattle. What becomes of the males? They do not count because they can not lay eggs and will not work for their own living. It is always best to keep the cattle in pen number three for ten to twenty days before moving them into tick free areas. This feed lot method of cleaning cattle of ticks is expensive because three pens must be built, the cattle fed and watered in the pens for fifty or sixty days. The expense could be reduced to a minimum by preparing good forage crops like kaffir corn, sorghum, cowpeas, soja beans, and corn thick in the row. Have the crops come so that the cattle can be fed green soiling forage throughout the fifty days. In order to make the water supply cheap build the first pen on the lower part of a small running branch where there are no ticks, build pen number two ten feet or more above it and pen number three ten or more feet above pen number two.

It will be cheaper to apply Beaumont oil thoroughly and

keep the cattle in a tick free pen where they can have good shade and plenty of water and feed for four days, then apply the oil thoroughly again and keep them in shady pen for three or four days more, and they will then be clean or free of cattle ticks, and ready to be turned into a tick free pasture or field.

2. Pastures or fields that are tick free may be used in the same way. Take a hay field of Johnson grass or red clover, or mellilotus, or of crab grass, or of any other forage or grass, divide it into three pastures or move the temporary partition fences every twenty days.

3. Where there are only one to five cattle, they can be staked and cleaned. Always begin at the lower part of the branch and stake the cattle so as to move the stake up the ditch or branch every day. Where the cattle were staked the first twenty to forty days, do not stake there again for three or four months.

WHEN SHOULD THE TICK KILLING MATERIALS BE USED.

If an effective or tick killing material is applied at first in the fall (beginning September or October 1st), and it is thoroughly applied once per week until December 1st or until frost appears; and during the winter as often as ticks are found; then keep up the thorough applications once per week from March until May, June or July 1—all the cattle ticks will be killed in the pasture and on the cattle. One thorough application of a good oil will usually kill all the ticks on the cattle, but as soon as the oil is rubbed or washed off the cattle will pick up other seed ticks in the infected pasture or lots. Applying the oil or other material once per week and sometimes once every two weeks will eradicate the ticks in a pasture because as fast as the ticks mature they are killed. Hence, if the mature ticks are all killed for four months in summer and six to eight months in winter all the tick eggs will have perished or hatched into seed ticks and the seed ticks will all have died from starvation or will have been killed on the cattle. This method

admits of beginning in the early spring or early fall,—say from March to December or from September to June. It is most effectual in good pastures where the cattle are confined during the spring, summer and fall in a fixed enclosure. Upon the ranges it is difficult to make it effectual because one or more cattle owners will often fail to regularly and thoroughly apply the tickicide.

II. Cleaning Pastures and Tick Infested Fields or Ranges.

1. Keep all cattle, horses and mules off of a given pasture, field or range four months in summer or six to eight months in winter and all the tick eggs will have perished or hatched and all seed ticks will have starved to death. The seed tick lives only on the blood of cattle, horses or mules.

(a) May 1, divide your pasture into two parts with a cattle tight fence so that cattle can not put their heads through between the wires. If possible put a six inch board on the ground or throw up a ridge with a plow on the fence line before the fence is built. Keep the cattle, horses and mules out of the high part (No. 1) and in the lower part (No. 2) from May 1 to October 1. Then move the cattle to a tick-free pen, oil them thoroughly once and in four days oil them again. Now they can be put into pasture number 1 or allowed to run in the corn or cotton field or other tick-free field. Pasture number 2 must be kept closed from October to May or June. The cattle may go into pasture number 1 any time after October 1, providing they are free of ticks. Sometimes the cattle may be turned out of pasture number 2 October 1 or December 1 into the corn field or cotton field and other cultivated fields—(all of which are tick-free in the fall). The time for turning them out will depend upon when the fields are ready and when frosts have appeared. After frosts and cold weather have come the life cycle of ticks is much prolonged and usually by the middle or last of December cattle are free of ticks, and remain clean

all winter providing they are not kept in infected barns, sheds or lots where heating manure hatches out the eggs. Hence, if cattle are turned out of pasture number one October 1 and allowed to run in cultivated fields until March 1 or sometimes until April 1, they may be examined closely for ticks, and if found tick free, can be turned into pasture number two. If not tick free, they should be cleaned by oiling thoroughly before turning them into pasture number two.

(b) September 1 take the cattle, mules and horses out any given pasture, keep them out continuously until the next May 1, and see that the cattle, horses and mules are clean of ticks before returning them to the pasture. This method has been used for several years very successfully by Dr. Butler of North Carolina. When tick free pastures or fields are made, they will remain tick free as long as ticks are not carried into such areas on cattle, horses or mules. In some rare cases, seed ticks or old females may be washed down from higher elevations into a low pasture.

(c) Cultivating land destroys ticks. It is possible that one or two good cultivations of land in summer will make it tick free.

(d) Burning the grass, leaves and weeds in the fall or spring will destroy many ticks, but it will not make a pasture entirely free of ticks. As a rule it should not be advocated because it destroys young timber and burns up vegetable matter.

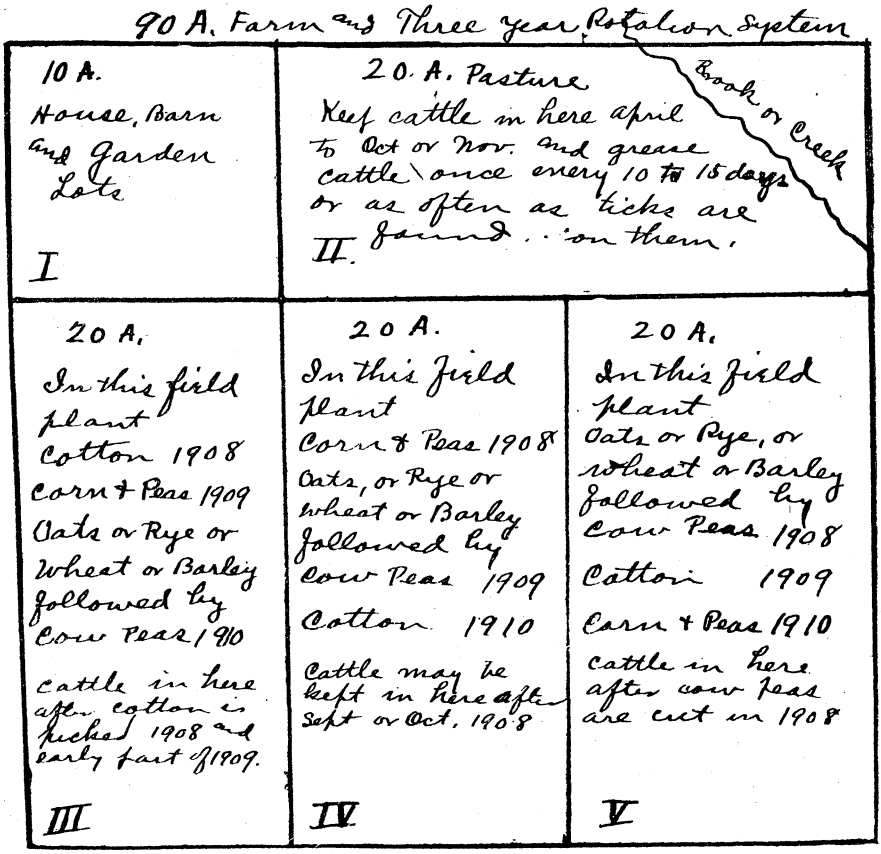
(e) Heavy, washing rains carry many of the eggs and seed ticks away.

(f) Some insects destroy many of the female ticks and tick eggs.

(g) Dry and hot, sunny places are hard on ticks—in fact seed ticks can not live one month in such places. Shade and a little moisture in hot weather favors the hatching of eggs and the longevity of the seed tick.

Rotation of Crops and Pastures Help Eradicate the Tick.

A few systems of rotation of crops are introduced into this bulletin to suggest ways by which concentrated feed, forage and hay can be produced in sufficient quantities on the farm to enable the farmer to handle his cattle and other live stock during the time of tick extermination with the least expense and trouble. The crop rotation systems are great aids to soil improvement and to the eradication or holding in check of cotton wilt or black root and other fungus diseases and insect pests. Moreover, rotation of crops means diversified farming and



forces the farmer to feed live stock on his farm or lose soil fertility by selling feed, forage and hay. Again, feeding live stock and growing legumes and other forage crops on the farm increases the vegetable matter or humus in the soil. Humus can not be bought in commercial fertilizers and the old worn lands are almost universally deficient in vegetable matter.

The rotation systems suggested are not iron clad, and may not be suitable to every farm. Yet the tick inspector and the farmer can study these and if they are not suitable as a whole or in part to a special farm, these will suggest others or methods of preparing a system adapted to the special farm.

In the ninety acre farm and three year rotation system, the plan adopted for eradicating the tick is oiling method with the cattle kept in the pasture from April until October or November or until they can be turned into the field where cow peas have been harvested or into the field where corn and peas have been removed, or into the cotton field after it has been picked. On this farm pasture II could be divided May 1, and either plan (a) or (b) of starving out the ticks and greasing the cattle only twice just previous to putting them into tick free areas could be employed. This three year rotation system was first suggested by Director Redding of Georgia.

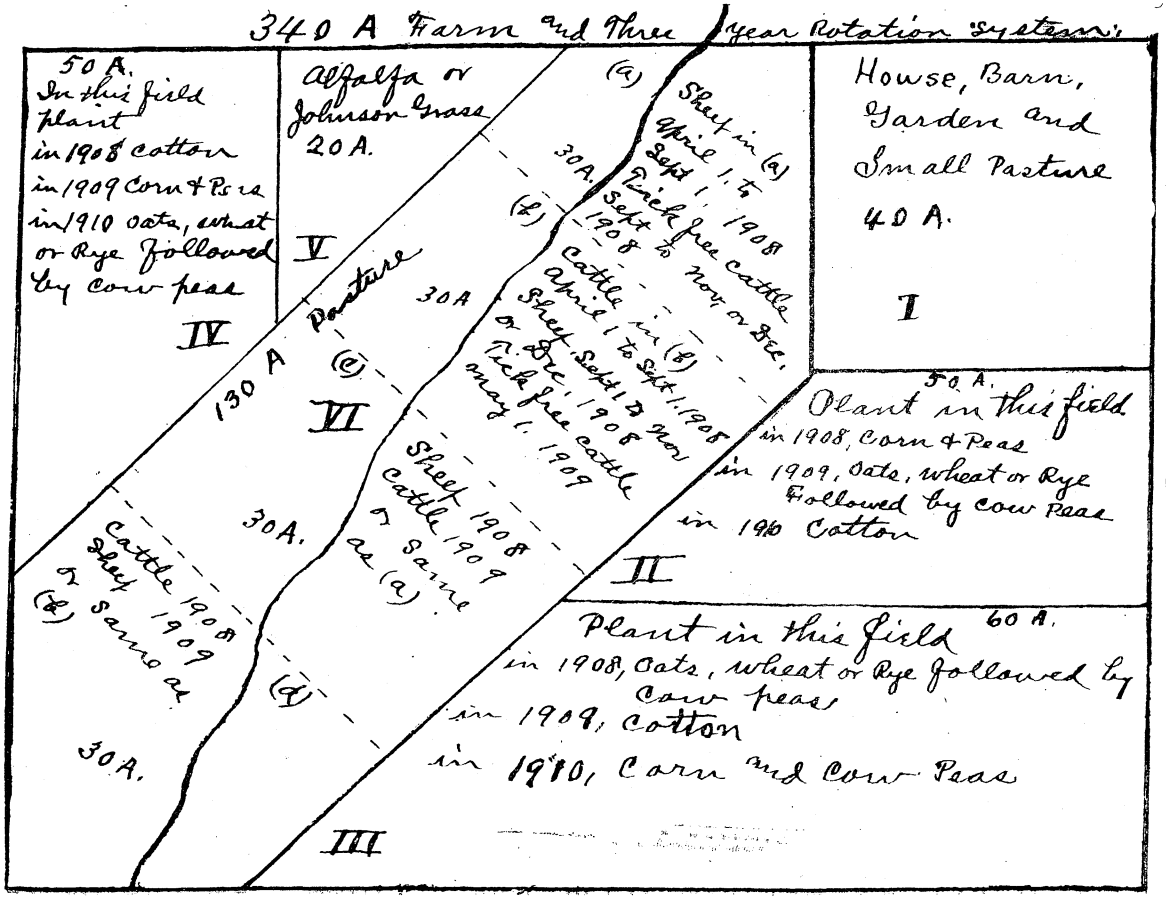

340 A Farm and Three Year Rotation Systems:
50 A.
In this field
plant
in 1908 Cotton
in 1909 Corn & Peas
in 1910 Oats, Wheat
or Rye followed
by Cow Peas
IV
Alfalfa or
Johnson Grass
20 A.
V
Pasture
30 A
(c)
130 A
VI
Cattle 1908
Sheep 1909
Same as (b)
30 A.
(b)
Sheep in (a)
April 1, to
Sept 1, 1908
30 A.
Sept 1 to Nov or Dec.
Tick free cattle
(f)
Cattle in (b)
April 1 to Sept 1. 1908
Sheep. Sept 1 to Nov
or Dec 1908 Tick free cattle
any 1. 1909
Sheep 1908
Cattle 1909
Same
as (a).
(d)
Cattle 1908
Sheep 1909
Same as
(e)
30 A.
III
House, Barn,
Garden and
Small Pasture
40 A.
I
50 A.
Plant in this field
in 1908, Corn & Peas
in 1909, Oats, Wheat or Rye
Followed by Cow Peas
in 1910 Cotton
II
60 A.
Plant in this field
in 1908, Oats, Wheat or Rye followed by
Cow Peas
in 1909, Cotton
in 1910, Corn and Cow Peas

FIG 6

The rotation system on the 340 acre farm is the same as on the 90 acre farm. But the methods employed in eradicating the tick are different. The pasture VI is divided into four parts. In (a) the sheep, goats, or hogs are kept from April 1 to September or Oct. 1, then they are removed to (b) and the cattle in (b) are cleaned by thoroughly oiling them twice, with four days between each oiling) or apply any other effective cattle dip twice; then after the cattle are kept for a few days in a tick free lot or pasture, they may be put into (a).

Or, the pasture might be divided into just two parts and the same plan employed. Instead of putting the cattle back into (a) they could go into the corn and pea field or into the cowpea field after those crops have been harvested, and after the cotton is out put the cattle into the cotton field. Keep them in the cultivated fields during the late fall and winter, and put them back into (a) in April. The cattle could not be moved into (b) before May or June 1.

It would not be advisable to try to grow alfalfa in part V unless the land was lime land or made sweet by sowing sufficient air slaked lime or ground lime rock on it. Nor would I advise planting Johnson grass on this land, but if it is already there, make the best of it by cutting it for hay always before it goes to seed.

Recent inevstigations indicate that sheep may be carriers of cattle ticks. Hence, it may be necessary to keep them out f pasture or other places where it is desirable to starve out cattle ticks.

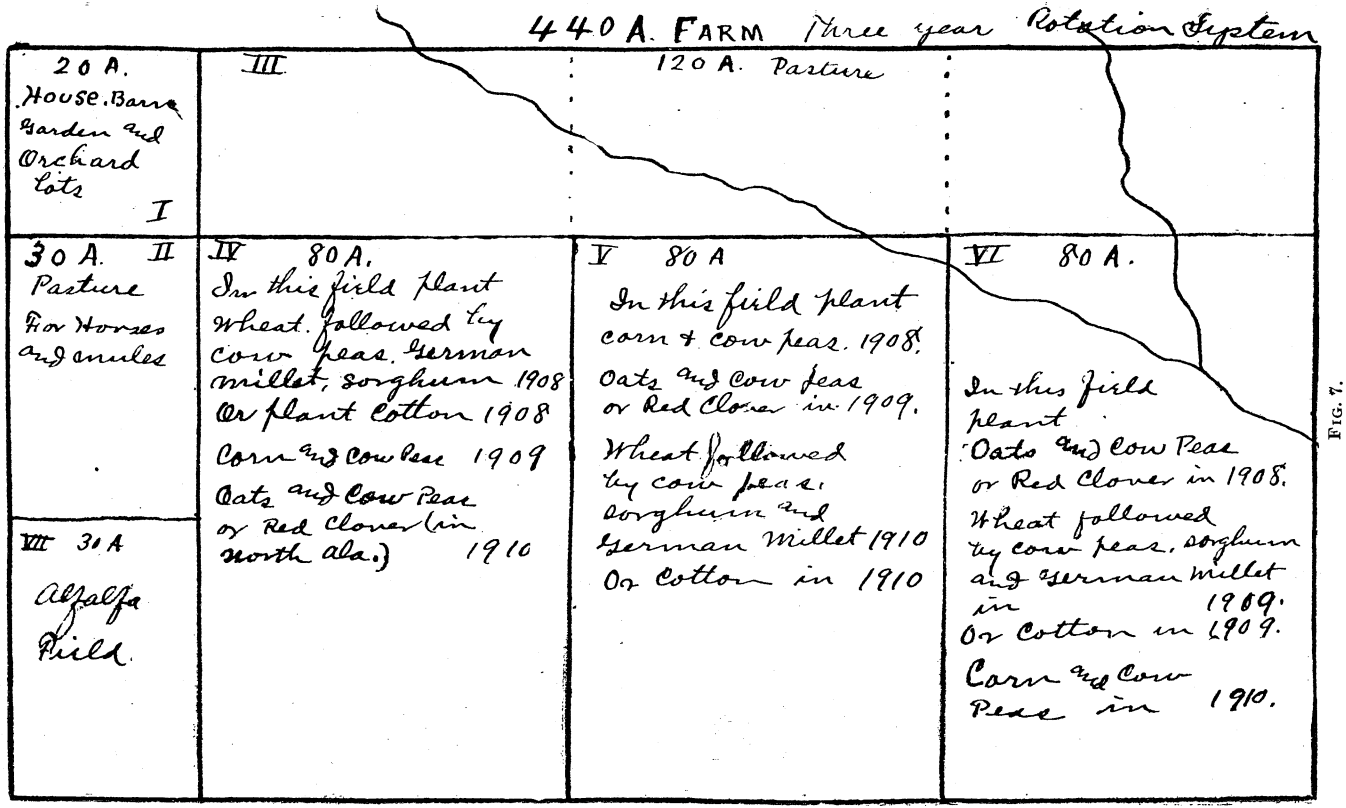

440 A. FARM Three year Rotation System
20 A. House. Barn Garden and Orchard lots I
III 120 A. Pasture
30 A. II Pasture For Horses and mules
IV 80 A. In this field plant Wheat. followed by cow peas. German millet, sorghum 1908 Or plant Cotton 1908 Corn and Cow Peas 1909 Oats and Cow Peas or Red Clover (in north ala.) 1910
V 80 A In this field plant corn & cow peas. 1908. Oats and Cow Peas or Red Clover in 1909. Wheat followed by cow peas. sorghum and German Millet 1910 Or Cotton in 1910
VI 80 A. In this field plant Oats and Cow Peas or Red Clover in 1908. Wheat followed by cow peas. sorghum and German Millet in 1909. Or Cotton in 1909. Corn and Cow Peas in 1910.
VII 31 A Alfalfa Field.

FIG. 7.

The rotation system on the 440 acre farm is also a three year system and very much like those given for the 90 acre and the 340 acre farms. But in this cotton is replaced, optional or divided with wheat followed by one or more of the following: cow peas, German millet, sorghum or soja beans. The oat crop is to be followed by cow peas, but red clover or alsike clover might be sown with the oats. Red clover, of course, could be used only in North Alabama.

The 120 acre pasture could be used for cattle and the cattle regularly oiled, or the pasture divided into two parts, on May 1 move all cattle, horses and mules into the part next to the house and barn. Keep all cattle, horses and mules out of the other part until October 1, then the clean cattle can be put into it. Or take all cattle, horses and mules out of the pasture about September 1 and keep the entire pasture closed to cattle, horses and mules until May 1 the next year; then put only tick clean cattle into the pasture.

460 A FARM. Four year Rotation System

70 A Pasture Bermuda and Carpet Grass Keep cattle in here from April until Sept or Oct Spray. Dip or grease cattle once every 10 days or as often as fine ticks are found on them		30 A. House, Barn Garden, Orchard Calf and Pig pastures	70 A. Pasture Bermuda and Carpet Grass. Keep cattle in here from April to Sept. Spray. dip or grease cattle every 10 days or every 5 days if ticks are found on them.	
60 A. Cotton in 1908 Corn + Peas 1909 Red Clover or Hairy Vetch + cow peas in 1910 Oats followed by Cow Peas 1911	60 A Corn + Peas 1908. Red Clover or Hairy Vetch and Cow Peas 1909. Oats followed by Cow peas 1910. Cotton in 1911	50 A Pasture or Part of it may be planted in Alfalfa	60 A. Red Clover or Hairy Vetch and cow peas 1908 Oats or Wheat followed by Cow peas 1909 Cotton in 1910 Corn + Peas 1911	60 A. Oats or Wheat or Rye or Barley followed by Cow peas in 1908 Cotton in 1909 Corn + Peas 1910 Red Clover or Hairy Vetch and Cow peas 1911

FIG. 8.

The four-year rotation system given on the 460 acre farm plan is one that is intended for a farm where large quantities of forage or hay crops are desired for feeding live stock. Notice that the soil improving crops are very prominent. The cow peas after oats could be replaced by soja beans—especially after the land has been improved by the rotation system and the use of stable manure. On this farm are two 70 acre pastures and 150 acre pastures. To clean the cattle and the pastures of ticks, the oiling method may be adopted or either of the other methods can be used. With this number of pastures fenced and all of the separate cultivated fields fenced, it would be relatively easy to clean all the cattle and all the pastures. Keep all of the cattle in one of the 70 acre pastures from April 1 to Sept 1, then move them into the corn and peas or the cow pea field after they have been harvested; later put them into the cotton field, and then shift them about on the cultivated fields until April or May 1. At that time, if the cattle are not clean of ticks thoroughly oil them or dip them twice, with four days between each oiling or dipping and put them into the other 70 acre pacture, out of which they were moved September 1. Thus in one year all of the pastures and cattle can be readily cleaned of cattle ticks.

When a pasture is vacated by cattle May 1, the low, rich, open, bottom lands may be plowed in August or September and sowed in winter rye or barley. These will give green grazing in the winter varying in quantity according to the fertility of the land and the cold or warmth of the winter.

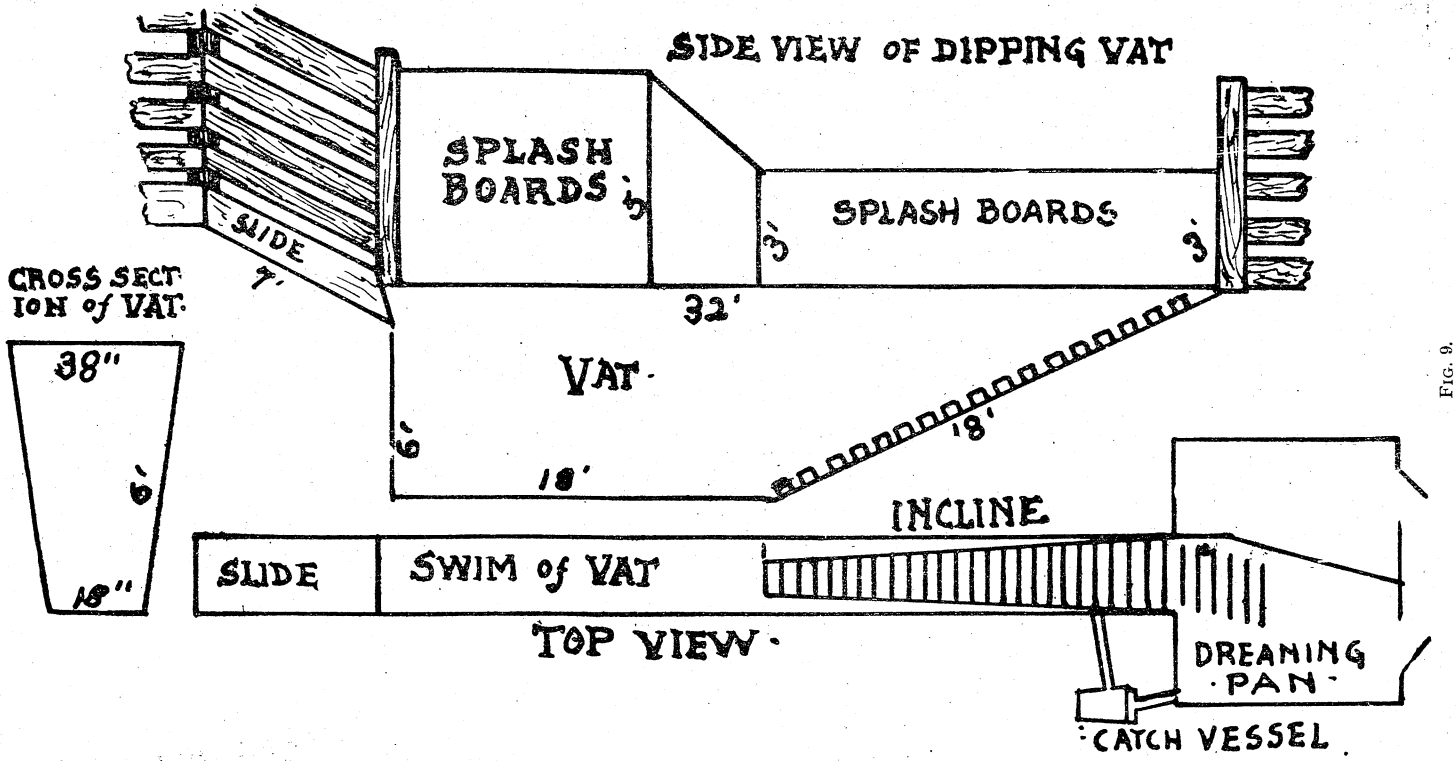

SIDE VIEW OF DIPPING VAT
SPLASH BOARDS
SLIDE
7'
3'
SPLASH BOARDS
3'
32'
CROSS SECTION of VAT
38"
6'
18"
VAT
6'
18'
18'
INCLINE
SLIDE
SWIM of VAT
TOP VIEW
DREANING PAN
CATCH VESSEL

FIG. 9.

How to Make the Vat.

Length of swim, 18 feet. Incline, 14 feet 1 in. "Slide," 7 to 8 ft., with drop of 3 ½ to 4 ft. Top width, 38 in. Bottom, 18 in. Depth, 6 ft. Set in ground 5 1-2 feet.

Frame with 2x4, every 16 to 18 inches.

Lay bottom of 2x18x18 ft. cypress. Then lay sides of 1x4 best flooring. Incline of 2x18x16 ft. cypress, cut in two pieces to fit, and dressed. Perpendicular end of same. "Slide" of good straight grained lumber, hardwood dressed, or soft wood covered with sheet-iron. It should be 7 feet long, with about a thirty degree slope. All joinings should be carefully fitted, and laid in coal tar or white lead. Quarter-round may be laid in angles to prevent leakage.

Dripping pen may be single or double. Should not drain into vat, but to one or both sides, where dip should be received into a suitable catch-vessel, through a screen, and allowed to settle before returning to vat, to get rid of filth. "Incline" and floor of dripping pen must be cleated.

A cover should be provided for the vat to prevent evaporation, which would concentrate the dip so that it would be of unknown strength and possibly unsafe to use. When not in use, drainage from dripping pen should be diverted from vat in case of rain, to prevent the dip in vat from being diluted.

Vat of the above measurements will require 2,000 gallons to fill 5½ feet deep. Dr. Parker, of Texas, wrote the specifications for this vat.

Bermuda.

Every permanent pasture in Alabama or the South should be set in Bermuda. All the upland and all the bottom lands that are not too wet are suitable places for it. The hill pasture lands should be terraced and set well in Bermuda. This will stop washing and hold fertility. The greatest mistake is made when one attempts to grow it on very poor, bare or washed land, without the use of fer-

tilizers. A complete commercial fertilizer, or stable manure will make it grow. When possible, it is always best to grow one or more crops of cow peas on the land after it has been terraced (if hill sides) and then plant in Bermuda. It is best to grow wheat, rye, barley, vetch or burr clover on the land in winter, between the times of growing the cow peas. These will act as catch crops, prevent the soil from washing and hold fertility. The best time to plant Bermuda roots or stems is during the wet weather in May, June or July. Dig up the Bermuda from a sodded place and be sure to avoid a place where nut grass or Johnson grass is growing. Also avoid carrying smut grass with the sod. The smut grass can be easily separated from the roots or stems of the Bermuda. Furrows may be opened from one to two feet apart and the Bermuda roots dropped into the furrows and covered with the plow. The Bermuda roots may be run through a corn cutter and then they will be more easily handled and will plant more ground. If the land is in corn, the Bermuda roots may be planted in the middles. This may prevent the corn from making a full crop, but with plenty of rain and fertile soil, it will make a good Bermuda sod. Burr clover or hairy vetch may be planted in the furrow with the Bermuda roots. The combination of Bermuda and burr clover will produce at least 10 months pasture in nearly every year. Bermuda on rich land will produce as much pasture as Kentucky blue grass will produce in Kentucky. Bermuda can be made to grow in the shade providing the soil is sufficiently fertile and the shade is not too dense. I have grown it under cedar trees, producing a solid sod. Its greatest enemies are smut grass and nut grass; and carpet grass will crowd it out of wet places. Japan clover is said to smother it some, but it will not do it only on poor land. In rich bottoms not too wet it will grow high enough to be cut for hay.

CARPET GRASS (PASPALUM PLATYCAULE).

This is also called blanket grass and Louisiana grass. It

grows readily on almost any kind of fertile soil. It will grow in the wet places where the Bermuda does not thrive and consequently it is often found covering the wet places in a Bermuda pasture. Grazing animals usually prefer it to Bermuda and will keep it eaten off close to the ground. It is said to crowd out weeds and other grasses, especially in wet places. The seed is expensive and it does not catch well from seed. Yet, when once started, it spreads rapidly—one plant is said to cover 10 to 20 square feet in one season. It is not a hay plant but an excellent pasture plant, ranking next to Bermuda in the South. It can be readily destroyed by plowing and cultivation.

RAPE.

Rape is a pasture plant for hogs and sheep, and may be used for cows and other animals.

It requires a rich loam soil well supplied with humus, or vegetable matter, and a complete fertilizer may be used on the soil to the amount of 300 to 800 pounds per acre. Plow the land well and deep, harrow and thoroughly pulverize by use of roller, clod crushers, and harrow. Sow from 3 to 5 pounds of Dwarf Essex seed per acre in drills or 6 to 8 pounds broadcast and brush over lightly.

It may be sown in summer, fall or spring, when the ground is moist enough to germinate the seed. When sufficiently large, graze it with hogs or sheep by using hurdles or by letting them run on all of it. It will continue to grow for several months, if not eaten down too closely to the ground or allowed to go to seed. It may be sown in between cotton or corn rows in August or September. It will not grow in dry seasons.

ALFALFA.

Alfalfa is a perennial forage plant which may be kept growing for twelve or more years, provided the weeds and its parasites do not kill it. Almost any fertile lime land, with no "hard pan" or rock near the surface, will

grow alfalfa. It is necessary to have the bottom land well drained, for alfalfa will not thrive in wet soil. One without any experience should begin with a few acres. Select good lime land, and if it is not lime land, apply, after plowing, on each acre 2,000 pounds of air slaked lime or 4,000 pounds of ground lime rock. It is best to apply the lime a short time before sowing the seed and harrow the plowed land to mix the lime well with the surface soil. It will not be necessary to apply the lime again for 5 to 8 years.

In preparing the land for alfalfa, it is best to begin one to three years before sowing the seed. Add all the stable manure you can each year to the land, and grow cow peas or soja beans in summer in drill and cultivate so as to kill out all the weeds. In winter time grow crimson clover, hairy vetch or wheat, rye or barley. After two or three years apply well rotted stable manure and 500 pounds of 16 per cent. acid phosphate per acre. Plow 10 to 15 inches deep with disc plow or one to two inches deeper than the land has ever been plowed with a three or four horse turn plow, following in each furrow with a long scooter or subsoiler. Harrow and roll until you have a finely pulverized seed bed. After cutting off the oats, wheat, rey, barley, crimson clover, or hairy vetch, the land could be kept cleanly cultivated by shallow plowing once every one or two weeks until the middle of August. Then the manure and phosphate could be applied and the land be plowed deeply, harrowed and rolled. After plowing, apply the lime or lime rock. Always do this previous to harrowing and rolling. Some time from the middle of August to last of September, sow 20 to 25 pounds of good alfalfa seed (free from weed seed). Sow it evenly and broadcast it. In order to inoculate the soil and the seed, secure 100 pounds of rich dirt or soil from any field where alfalfa, mellilotus, or burr clover is growing or has grown within a year of the time you take the soil. Place this soil in a box, wet the alfalfa seed and thoroughly mix it with the pulverized

soil in the box. Sow the soil and seed broadcast over the acre of prepared land and brush in lightly.

As a rule the young plants will get sufficiently large to resist the freezing and lifting frosts of winter, and the next spring the young alfalfa will grow so early and rapidly that it will keep down the weeds. But should you fail to get a stand from the fall sowing, the same land may be easily prepared for seeding again in the same way and at any time from March 1 to April 1.

When the little branches begin to start out from near the base of the stem or just about blooming time, the alfalfa should be cut, and after removing the hay, the alfalfa stubble, if weedy, may be harrowed with a tooth harrow to destroy weeds and loosen up the ground. And after the first summer every time it is cut, it may be run over with a disc harrow having the discs set straight and then run over it in a direction at right angles to the way that the disc harrow ran, with a tooth harrow. This kills and keeps down weeds, loosens up the soil, admits air, and retains moisture.

The essentials for growing alfalfa are lime, manure, fertile soil, and absence of weeds, grass and parasites.

Dodder, or "love vine," is one of the worst parasitic enemies of alfalfa. When once started, it may be kept in check by hoeing it out and all the alfalfa for several feet around it. Pile up the dodder and alfalfa in the center of the cleared space and burn it when dry. Do not allow anything to grow on these bare places for one or more years. As a rule, the only way to kill out dodder in an alfalfa patch is to plow up the alfalfa and put that land in cotton and then in corn. Crab grass and chick weeds are plants that will crowd out or choke out alfalfa.

Crimson Clover.

This clover grows best in the fall, winter and spring, and may be sown in between the cotton or corn rows from latter part of August up to the fifteenth of October. If the ground is rich or has been made fertile by using stable

manure on the corn or cotton, 200 to 500 pounds of 16 per cent. acid phosphate and a little potash may be all the fertilizer required. Sow 20 pounds of good seed and cover with small harrow or shallow cultivation. If it is to be sown on freshly plowed land, it is best to run the roller over the ground after harrowing in the seed. When possible, secure 100 pounds of dirt from a field where red, white, or alsike clover or crimson clover has been grown luxuriantly within one year. Wet the 20 pounds of crimson clover seed and then thoroughly mix the 100 pounds of dirt with the seed. Now sow the mixture of dirt and seed on the freshly harrowed land. Harrow again after sewing, and then roll the land, if not in corn or cotton. This is to inoculate the seed and the land. It will not do to sow it in the late fall, in winter, in spring, or in early summer. It will be ready for cutting when it blooms in May or early June. It can be followed by cow peas, sorghum, soja beans, or late corn. In case you can not secure inoculated soil for inoculating the seed as above directed, use plenty of stable manure on a small piece of fertile land, and the next year the soil from this land will do for inoculating more seed and land. To be sure that a given soil is inoculated, examine the rootlets of the young or old clover plants growing on the land, for the bunches of little nodules. When the land does not contain lime, an application of 1,000 to 2,000 pounds of air slaked lime to the land before sowing the seed will help the growth of crimson clover. It should not be planted on wet land, or low undrained wet land.

Hairy Vetch.

One of the best legumes for collecting the nitrogen from the air, for making proteid or nitrogenous forage which is equal to wheat bran in feeding value, and for adding vegetable matter and nitrogen to the soil, is hairy vetch. It does not require lime land but some claim that it will grow best on sweet soil. It may be planted with winter oats, wheat, rye, or barley. But, as a rule, it does best

with oats. Yet it is rare that any of these cereals are ready for making the best hay when the hairy vetch is in bloom and ready for cutting. It can be sown on Bermuda sod in June, July or August. If the Bermuda is on rich land and is not pastured too close, the hairy vetch will take hold and grow vigorously after the fall rains. It would be better to cut up or scarify Bermuda sod with a scooter or some other plow and then sow the seed and harrow with a disc harrow. Hairy vetch may be drilled or sown in between the corn, sorghum, or cotton rows in August or September. If sown by hand, cover by shallow cultivation. It is well to use 300 to 500 pounds of 16 per cent. acid phosphate on each acre of land and a little potash. And if not inoculated, use plenty of stable manure. The seed and the land can be inoculated by getting a 100 pounds or more dirt from a field where hairy vetch or some other vetch grew the previous year or season, or from a place in the garden where English peas grew the previous year or season. Wet the seed with water and then mix the seed and dirt. Sow the mixture of dirt and seed over freshly harrowed or plowed land, and harrow again and then roll the land. This plant will stand more freezing than rye. Sow about thirty pounds of seed per acre. If used with oats or wheat, sow 1 to 2 pecks of hairy vetch seed with one to one and a half bushels of oats or wheat. The vetch seed may be sown with the inoculated dirt and then the wheat or oats can be sown broadcast or drilled.

Alsike and Red Clover.

It is doubtful if either of these two clovers can be successfully grown anywhere south of the Tennessee river valley in Alabama. In all places where the land is "clover sick" for red clover, use alsike. Here I can not do better than quote a letter from Director H. A. Morgan of the Tennessee station: "Regarding the preparation of land for alsike clover or red clover, we handle it something this way: In order to rid the land of weeds, which are

natural upon most of our lands, put the land in peas, after making an application of lime—three or four thousand pounds to the acre of ground limestone rock and about two thousand pounds of the burnt lime. Disc this into the surface of the plowed ground a week or two before sowing the peas. After the peas are taken off, the land may be sown to a winter cereal, such as rye, wheat or fall oats, and, in early spring, seed to alsike clover, putting in plenty of good seed. We use as much as 10 to 12 pounds to the acre on our poor lands.

I do not believe, from our experience here, that it would be wise for you to recommend red clover until sufficient seed from immunized clover plants can be procured. Red clover is universally affected with a species of Colletotrichum, an anthracnose, and in the Middle Southern States undoubtedly dies from this disease. We have every promise, from our experiments with clover this year, finally to work out immune varieties, and I hope that this will be only a matter of three or four years. In the meantime, we are recommending alsike on well limed land. Alsike, as you remember noticeing when at the station, is exceedingly sensitive to an acid soil, and therefore accepts beautifully a lime application.

Mellilotus or Sweet Clover.

For the redemption of bare, poor lime lands no plant equals mellilotus. It is a bienniel and when once started will readily reseed itself if not kept from going to seed by frequent cutting with the mover.

The land should be well prepared and the seed sown in September or March, at the rate of 15 to 20 pounds per acre. It will do well on lime land where Johnson grass has a good hold. If cut early it will make good hay. It will also stand pasturing, but at first some animals must be kept on it for several days before they will eat it. The seed can be inoculated with dirt from an old mellilotus field or from a field of alfalfa or burr clover.

BURR CLOVER.

This is a close relative of alfalfa and is an excellent winter growing plant. It will grow on almost any kind of fertile soil that is not too wet. But it will grow best on lime land. It may be sown broadcast in between the cotton or corn rows just before the last plowing in June or July, using 2 to 3 bushels in the burr. Do not use the California burr clover seed. It can be sown broadcast, in June, July or August on scarified Bermuda sod, or on disced wheat, rye or barley stubble. If the seed with the burr removed is used, it may be sown as late as September. It is well to roll the land after harrowing in the seed that is sown in September. If not eaten off too close in the spring, it will reseed itself. In South Alabama it will furnish good winter pasture from December to April. Very cold weather may freeze back the top growth, but warm weather will bring it out again. As a rule the seed in the burr is inoculated, but it can be inoculated by using dirt from a mellilotus field, an alfalfa field, or a burr clover field. It is best to inoculate the seed that is cleaned of the burr, or use plenty of stable manure. Do not attempt to grow it on poor soil. Better grow a crop of cow peas on the land and then fertilize well before trying burr clover. This is not a good hay plant. Better plant hairy vetch, crimson clover, or red clover, or alsike clover for hay. Burr clover is a winter and spring plant.

No. 333.) AN ACT. (S. 165.

To establish a State Live Stock Sanitary Board and the office of State Veterinarian in order to further protect live stock from contagious and infectious diseases and provide for eradicating and excluding such diseases from Alabama.

Section 1. Be it enacted by the Legislature of Alabama, That from and after the passage of this act, the commissioner of agriculture and industries of the State of Alabama, the State health officer of Alabama, the pro-

fessor of animal industry and the professor of veterinary science, of the Alabama Polytechnic Institute shall, ex-officio, constitute a board to be known as the State Live Stock Sanitary Board. The commissioner of agriculture and industries shall be chairman and the veterinarian on the board shall act as secretary of the board. The State Live Stock Sanitary Board shall have full power to make or enact such rules and regulations as they may deem necessary for governing the movements, transportation or disposition of live stock that may be quarantined as hereinafter provided, on account of being affected with, or exposed to, a contagious or communicable disease, or on account of being infected or infested with the carrier or the carriers of the cause or the causes of a contagious infectious or communicable disease of live stock.

Sec. 2. Be it further enacted, That the professor of veterinary science of the Alabama Polytechnic Institute shall act as State Veterinarian of Alabama. The State veterinarian shall nominate, and the State Live Stock Sanitary Board shall elect, as many assistant State veterinarians and State live stock inspectors as they may deem necessary and as the funds at their disposal shall permit.

Sec. 3. Be it further enacted, That the State veterinarian is authorized and directed to quarantine a stall, lot, yard, pasture, field, farm, town, city, township, county, or any part of the State of Alabama when he shall determine the fact that live stock in such place or places are affected with a contagious, infectious, or communicable disease, or when said live stock are infested or infected with the carrier or the carriers of a contagious, infectious or communicable disease. The State Veterinarian or an assistant State Veterinarian shall give written or printed notices of the establishment of said quarantine to the owners or keepers of said live stock, and to the proper officers of railroad, steamboat, or other transportation companies doing business in or through the quarantined part or parts of the State.

Sec. 4. Be it further enacted, That no railroad company, or the owners or masters of any steam or other vessel or boat shall receive for transportation or shall transport live stock from any quarantined part into any other part of Alabama except as hereinafter provided. No person, corporation or company shall deliver live stock for transportation to any railroad company or sailing or steam vessel or boat in a quarantined part of Alabama, except as hereinafter provided. No person, company or corporation shall drive or cause to be driven, live stock on foot, or transport live stock in a private conveyance, or cause live stock to be transported in a private conveyance from a quarantined part to a non-quarantined part of Alabama, except as hereinafter provided.

Sec. 5. Be it further enacted, That live stock may be moved within the limits of a quarantined part or from a quarantined part of Alabama only under, and in compliance with, the rules and regulations of the State Live Stock Sanitary Board. It shall be unlawful to move or allow to be moved, any live stock from one place to another within the limits of a quarantined or from a quarantined part to a non-quarantined part of Alabama, in any other manner or method, or under any conditions other than those prescribed by the rules and regulations of the State Live Stock Sanitary Board.

Sec. 6. Be it further enacted, That all live stock, except such live stock as are to be used for immediate slaughter, when brought into Alabama by a person, company, corporation, railroad or other transportation companies, shall be accompanied by a certificate of health, and said certificate shall state that said animal or animals are free of contagious, infectious or communicable disease and the carrier or the carriers of the cause or the causes of such diseases. This certificate must be made by a qualified veterinarian immediately after he has personally examined the live stock and before the live stock has been shipped into Alabama. This certificate shall be attached to, and accompany, the shipping bill of the live stock to

the place to which the live stock is shipped, and the owner of the live stock or agent of the transportation company shall mail or send said certificate to the State veterinarian, immediately following the arrival of the live stock at its place of destination. The State veterinarian shall furnish qualified veterinarians and transportation companies with blank health certificates at actual cost.

Sec. 7. Be it further enacted, That owners, renters, or parties in possession of quarantined live stock or quarantined places shall follow the directions in the rules and regulations of the State Live Stock Sanitary Board in cleaning and disinfecting infected live stock and infested or infected quarantined places, and in destroying the carriers of the cause of a contagious, infectious or communicable disease, that infest or infect live stock and quarantined places. Said cleaning of said live stock and the disinfecting of said places and destroying of said carriers shall be done by the owners, or the parties in possession of the infected live stock and places, in a reasonable time after receiving a written or printed notice from the State veterinarian, an assistant State veterinarian, or a State live stock inspector. Any person, company or corporation violating the provisions of this section shall be guilty of a misdemeanor and on conviction, shall be punished for each and every violation by a fine not less than ten dollars, nor more than one hundred dollars, or by imprisonment not less than ten days nor more than sixty days, or by both such fine and imprisonment.

Sec. 8. Be it further enacted, That the State veterinarian, the assistant State veterinarian and the State live stock inspectors are hereby empowered to enter upon the premises or into any barns or other buildings where live stock are temporarily or permanently kept in the State of Alabama in the discharge of the duties prescribed in this act. Any person or persons who forcibly assault, resist, oppose, prevent ,impede, or interfere with the State veterinarian, an assistant State veterinarian, or a State live stock inspector in the execution of his or their

duties, or on account of the execution of his or their duties, on conviction, shall be punished as provided in Section 11 of this act.

Sec. 9. Be it further enacted, That the work of cattle tick eradication or the suppression or eradication of any other infectious, contagious or communicable disease of live stock shall be taken up under the provisions of this act in any county or any part of a county or any part of the State of Alabama, when the State Live Stock Sanitary Board may deem it best. The county commissioners of any county in which the State or Federal authorities take up the work of tick eradication or the suppression of any infectious, contagious or communicable disease of live stock, may appropriate, for aiding in such work, such sum as the county commissioners may deem adequate and necessary.

Sec. 10. Be it further enacted, That the State Live Stock Sanitary Board may appoint or elect the Federal veterinarians and live stock inspectors, who are doing work in Alabama, as assistant State veterinarians and State live stock inspectors; provided, they consent to act without pay from the State of Alabama.

Sec. 11. Be it further enacted, That any person, persons, company or corporation violating the provisions of Sections 4, 5, 6 or 8, of this act, shall be guilty of a misdemeanor and, on conviction, shall be punished by a fine of not less than fifty dollars, nor more than five hundred dollars, or by imprisonment of not less than one month nor more than six months, or by both fine and imprisonment.

Sec. 12. Be it further enacted, That there is hereby appropriated annually the sum of five thousand dollars to be disbursed under the direction of the State Live Stock Sanitary Board to pay the actual expenses of the Live Stock Sanitary Board in attending meetings; to pay for the printing of the official blanks, the annual reports of the State veterinarian and the rules and regulations of the Live Stock Sanitary Board, to pay the State

veterinarian five hundred dollars per year and expenses while on actual duty; each assistant State veterinarian five dollars per day and expenses while on actual duty, and each State live stock inspector one to three dollars per day and expenses while on actual duty; and to pay such other expenses as may be necessary in carrying out the provisions of this act.

Sec. 13. Be it further enacted, That the judges of the circuit and criminal courts shall give this act in special charge to each future grand jury empanelled in this State, and that such grand jury be clothed with, and authorized to exercise inquisitorial power for the carrying out, and the enforcement of, this act.

Sec. 14. Be it further enacted, That the State veterinarian shall make an annual report to the Governor of Alabama, giving a full account of the work done and a detailed report of the money expended.

Sec. 15. Be it further enacted, That all acts not in accord with this act, are hereby repealed.

Approved March 12, 1907.

Official:

Frank N. Julian, Secretary of State.