# A System For All Seasons: the immunisation of sheep against clostridial disease

**Presented by The Cooper Agricultural Division of The Wellcome Foundation, 1973.**

**An A W Oakes Production**

**Colour**
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**<Opening titles>**

**<Narration over film>**

Don't gamble with your sheep. Much unthriftiness and loss of livestock can be prevented by good husbandry: grassland management in its widest sense, hygiene, housing, feeding and attention to the general condition of the animal. There are times when good husbandry, far from helping, can increase the chance of disease. For instance, it's well known that the husbandry required to produce early fat lambs increases the risk of pulpy kidney disease.

Pulpy kidney disease is caused by a germ of the clostridia family, a group of related bacteria responsible for disease in man, all farm animals and many other species. Sheep are unfortunately prone to a larger number of these lethal diseases than most other animals. The clostridial diseases of British Sheep are: blackleg, black disease, braxy, tetanus, lamb dysentery, struck and pulpy kidney disease. These are caused by *Clostridium chauvoei, Clostridium oedematiens* types B and D, *Clostridium septicum, Clostridium tetani, Clostridium welchii* types B, C and D. Struck and pulpy kidney disease are often known as enterotoxaemia.

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| **BLACKLEG** | **Clostridium chauvoei** | |
| **BLACK DISEASE** | **"** | **oedematiens Type B** |
| **Cl. oedematiens Type D** | **"** | **oedematiens Type D** |
| **BRAXY** | **"** | **septicum** |
| **TETANUS** | **"** | **tetani** |
| **LAMB DYSENTERY** | **"** | **welchii Type B** |
| **STRUCK** | **"** | **welchii Type C** |
| **PULPY KIDNEY** | **"** | **welchii Type D** |

Struck affects sheep only in certain localities, but most of the diseases are fairly widespread, occurring in most parts of the British Isles, in particular the risk of blackleg, tetanus and pulpy kidney disease is ever present.

As clostridial bacteria are common inhabitants of the soil, sheep are in constant contact with them. They lie amongst them, they eat them, and the bacteria can enter any small wound or scratch. Consequently, a large number of sheep harbour these bacteria in their gut or other parts of the body where they cause no ill effects, unless other factors trigger off disease. Unlike animals, plants and most other bacteria, clostridia do not need oxygen for life or growth. Therefore they can grow readily inside such places like the bottom of a deep puncture wound. They mainly act by producing poisonous toxins which are carried by the bloodstream throughout the body and kill the animal.

There is little that can be done by husbandry to prevent the diseases since they’re all produced by bacteria from the soil. Therefore the only safeguard is immunisation, protection by the use of vaccines or antisera. A review of the basic principles of immunisation against clostridial diseases will show how the vaccines or antisera work.

When bacteria enter the body, the animal’s built-in defence mechanism attempts to neutralise and eradicate them. The neutralising substances or antibodies are stimulated by the invaders or antigens. Very severe infections can cause death, but if

the animal survives, the antibodies produced may render it immune to that particular disease for a time. However, as a general rule, animals do not survive clostridial infections.

Sheep can be safely protected against clostridial diseases by injecting killed bacteria or killed toxins, because the defences cannot distinguish the difference and will still produce antibodies. This is the principle of a vaccine. The type of immunisation which makes the sheep actively produce its own protection is therefore known as active immunisation, produced by the injection of vaccines. Ready-made antibodies can also be injected into sheep by using an antiserum. Because they contain ready-made antibodies, antisera give virtually immediate protection, but it's short-lived compared with that produced by a vaccine. Antisera are usually prepared by actively immunising horses and collecting the antibodies they produce. But, they're rapidly lost in the sheep because, being of horse origin, they are foreign to it and the body exerts itself to destroy them quickly, so protection will only last up to three weeks.

Because the sheep doesn't have to work to produce the antibodies, but merely receives them, this is known as passive immunity. Antisera can be used to protect sheep during short periods of high risk such as at docking time. They can also give immediate protection if an outbreak occurs in an unvaccinated flock. Lamb dysentery is fatal in lambs less than 14 days old, so the use of antiserum is ideal for them although finding each lamb as soon as possible after birth can be a major drawback.

There is another and more important type of passive immunity, natural passive immunity, which occurs when a lamb receives antibodies by sucking colostrum from its vaccinated mother. As long as it gets the colostrum before its 12 to 15 hours old, a lamb is able to absorb these antibodies through its gut. This way the protection is far superior to that of a dose of antiserum both in numbers of antibodies and the length of time they will remain before being completely destroyed. As the antibodies are of sheep origin, they will persist for 12 to 15 weeks, superb protection indeed.

Returning to active immunisation, it must be remembered that the injected sheep is required to produce its own antibodies. A sheep with no immunity against clostridial

diseases requires about 14 days after the first injection before any antibodies appear. They will increase to only a moderate peak and then decline to very low amounts after about 12 weeks. A second injection, after a sufficient time lapse, produces quite a different effect: the sheep is now able to produce large numbers of antibodies quickly – there's no 14 day gap before starting to increase, instead high peak levels are reached in that time. The same response will occur every time the sheep is reinjected with the same vaccine. Although it's after the second dose that proper immunity is achieved, it is paradoxically the very first dose of vaccine which is important. This dose is the very foundation on which a sound immunity is built. 14 days elapse between the injection of the first dose and the appearance of antibodies because the sheep's defence mechanism, not having met this invader before, has to recognise it and train its antibody-forming tissues to produce antibodies against it. The most important function of the first dose is to train or sensitise the defences so that antibodies can be produced rapidly when future contact with the antigen is made. The injected vaccine disperses to make contact with the antibody-forming tissues, which respond by becoming sensitised. Some antibodies will be produced but the main purpose of the first dose is to sensitise. This is one of the most important basic principles in immunity to clostridial diseases.

In some cases, it's been shown that a larger volume is desirable for the first dose. The quantity of the first dose has an effect upon responses to future doses, because the wider the spread of vaccine, the greater the amount of antibody-forming tissues which become sensitised.

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To apply these basic principles to the sheep farming programme, the Convexin System can be taken as a model as it fully illustrates all the principles. Sheep are brought into the system by an initial course of 2 injections. The first dose is 5 millilitres of vaccine, whereas the second and all subsequent doses are 2 millilitres. At least 6 weeks should elapse between these injections, because the body defences need time to recognise the antigen and then organise antibody production.

6 weeks later when the tissues are thoroughly sensitised, the second dose completes the protection.

5 millilitres are used for the first dose because it's the keystone of any vaccination programme, particularly when aiming to protect against eight diseases with a single vaccine. The larger volume at this stage will provide the best possible preparation for the future. If the defences have been properly prepared by the first dose then subsequent doses can be reduced to 2 millilitres without loss of effectiveness. After the second dose, antibodies will be at their peak within 2 weeks and will persist for about 6 months. For continuous protection, it is therefore necessary to give booster injections every 6 months. It's important to give a booster to pregnant ewes about 2 weeks before lambing is due in the flock. This ensures that the ewes have peak levels of antibodies when they lamb, providing high concentrations in the colostrum, when needed, to be passed on to the newborn lambs.

The lamb which sucks colostrum in the first 12 to 15 hours will receive antibodies enough to protect it for 12 to 16 weeks. A lamb which is put to a foster mother will not receive colostrum and it is colostrum which is richest in antibodies. Such lambs will not be protected unless they're either put to a ewe which has colostrum, or fed with it from a bottle. When an orphan lamb is bottle fed, it must receive colostrum in the first few hours of life in order to utilise the protective antibodies.

The Convexin System is an 8 in 1 vaccine. 8 in 1 vaccines are increasingly used because they possess several obvious advantages. Firstly, the sheep are protected economically against 8 diseases by inoculation with only 1 vaccine, not by 8 single inoculations. Secondly, it cannot be predicted which disease will occur or where or when. For instance, unsuspected outbreaks of black disease or blackleg have many times ruined a sheep farmer's programme. An 8 in 1 programme caters for all the permutations wherever they may occur. Thirdly, now that sheep are moved about the country more than ever before, they're often faced with a variety of disease risks. Fourthly, as antibodies are produced specifically for each particular antigen, that is for each separate disease, it's an advantage to sensitise sheep to all the important

clostridial antigens, so that they respond to any or all of them at a later date. A sufficiently powerful first dose will do this.

If a vaccine with limited cover has been used originally, for example a vaccine against tetanus and pulpy kidney disease, then it's more difficult to ensure a balanced response should it become necessary to use a vaccine with wider cover because of new disease risks. For instance, if a risk of black disease now arises and the sheep is given a 2 millilitre dose of full-cover vaccine, then it will respond best to the tetanus and pulpy kidney components of the new vaccine, probably at the expense of the other components. If a larger quantity of vaccine is used for the first dose, as in the 5 millilitre first dose of Convexin, this tendency to unbalanced response is largely overcome.

Lastly, there are the economics to consider. Clostridial diseases are notoriously difficult to diagnose. They're probably responsible for the odd unaccountable deaths among sheep each year. After all, the bacteria are always present in the soil. The cost of vaccine is low. The cost of the loss of one sheep will probably pay for the first dose of vaccine for over 100 sheep or a maintenance dose for nearly 300. Vaccination is a form of insurance and a good 8 in 1 vaccine is the most comprehensive form against clostridial disease. It's not only comprehensive but it's also simple and logical in its application, as becomes apparent when following a year's cycle in the Convexin System.

The most suitable time to put ewes into the system with the 5 millilitre dose is in the late summer or autumn at tupping time. In an area where there's a risk of clostridial disease in the winter months, a 2 millilitre second dose should be given 6 weeks after the first, followed later by a pre-lambing injection. When there is no risk, the second dose can be left until the flock is 2 weeks from the start of lambing so that the in lamb ewes can create high amounts of antibody by the time lambing begins. Not only will the ewes be protected, but they will pass on to their lambs sufficient passive protection to last from 12 to 16 weeks, provided the lambs suck colostrum in the first 15 hours of life. If they do not, they will not be protected. Lambs from vaccinated ewes will thus be protected through all the main risk periods of their early life, but as

their passive protection wears off, it must be replaced by active protection if they're kept for longer than about 4 months. Lambs to be retained can be given their first 5 millilitre dose at 10 to 12 weeks of age. Then after another 6 weeks, the second dose of 2 millilitres should be given. With the older stock, they now fall into the regular 6 monthly pattern of booster injections, autumn and spring.

In areas where there's no risk of clostridial disease in the winter, the autumn injection need not be given, but there is then a risk in the period just before the pre-lambing injection when antibodies may not be sufficiently high to prevent disease.

One must not forget, of course, that hygienic measures should be practised when injecting sheep, whether the traditional, single-dose syringe or a modern, pre-sterilised, disposable, automatic syringe is used. One of the advantages of the automatic syringe is that it fills itself mechanically every time the plunger is released, thus saving valuable time when a number of sheep have to be injected. Remember though that the time saved is in filling and that due care must always be taken when making the actual injection.

This then is the simple, effective and economical way to protect sheep. Although losses may run at a low level for several years in an unvaccinated flock, sooner or later they can assume sizable proportions and it's far better to be safe than sorry. Vaccination is a form of insurance which only the gambler ignores.

**<End credits>**

**The producers wish to thank everyone who gave assistance or provided facilities during the making of this film.**