

Selenium deficiency in sheep

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Selenium is an essential element in the diet of animals and has a variety of roles:

1. As an anti-oxidant in conjunction with vitamin E to prevent and repair cell damage
2. In immune function
3. In growth and fertility.

A deficiency can cause white muscle disease (WMD) in lambs and weaners, scouring, ill thrift and lowered wool production in weaners and hoggets and in some cases infertility in ewes.

There are other diseases that cause similar clinical signs, and there are also other diseases which may be caused by a combination of low levels of both selenium and vitamin E.

Selenium deficiency must be confirmed as the cause of disease before treatment because selenium can be toxic if given in excess amounts.

Causes of selenium deficiency

Four factors can predispose sheep to selenium deficiency. These are:

- acidic basalt/granite soils and sandy soils
- annual rainfall over 450 mm
- clover dominant pastures
- heavy or long-term fertiliser application, particularly with sulfur-fortified superphosphate or gypsum.

A combination of some or all of these factors will predispose sheep to selenium deficiency.

Outbreaks of white muscle disease and responses to selenium supplementation are more likely in lambs grazing in lush seasons on heavily fertilised, clover dominant pastures on the tablelands (figure 1).

Similarly, weaner ill thrift and scouring due to selenium deficiency will occur in good years but is less likely in dry years or under drought conditions.

Selenium deficiency can occur in other special circumstances. For example, clinical white muscle disease which responds to selenium has been seen in young lambs born to ewes that had been fed on wheat for most of their pregnancy. Some grains may be low in selenium, depending on the area in which they are grown.

Areas affected

The areas where selenium deficiency in sheep is likely to occur are shown in the map below.

Figure 1 Areas where selenium deficiency occurs in sheep in NSW



White muscle disease occurs regularly on improved Northern Tablelands country and on highly improved properties of the Central and Southern Tablelands and Slopes. In these districts, losses can be expected in good spring seasons when there is lush clover growth.

Within the areas shown on the map, there are also properties where no production responses would be expected following selenium supplementation. These are the unimproved properties, with little fertiliser application and no highly improved pastures.

Selenium deficiency in sheep has not been diagnosed on the plains or in the irrigation areas.

Selenium deficiency in dairy cattle can occur in areas other than those shown on the map.

However, it is not associated with deficiency in sheep because of the differences in diet. Dairy cattle fed on concentrate rations incorporating grains low in selenium may develop selenium deficiency in areas where grazing animals are not affected.

Symptoms of selenium deficiency

The diseases associated with selenium deficiency are listed in Table 1.

White muscle disease

White muscle disease (WMD) also known as 'subacute enzootic muscular dystrophy' or 'stiff-lamb disease' can occur in newborn lambs, but is more commonly seen in lambs up to 3 months of age.

Congenital white muscle disease

Congenital white muscle disease (in newborn lambs) may show up as poor lamb viability and an increased perinatal mortality. Affected lambs may either be born dead or die shortly after birth, or may not be able to suckle or to follow the ewe. Such lambs will die.

Delayed WMD (or stiff lamb disease)

Delayed WMD occurs in lambs from 1 to 3 months of age (figure 2). Lambs may be affected in both forelimbs, both hind limbs and all four limbs, with no evidence of any swelling.

If able to stand, affected lambs have a stiff, stilted gait and an arched back; they exhibit muscle trembles and weakness. Affected lambs lie on their chest then roll onto their side and die within a few days.

The disease occasionally affects the muscles of the limbs and the heart, showing up as white patches or flecks in affected muscles.

In early cases the muscle is pale, like fish flesh. Laboratory examination may be needed to confirm the diagnosis.

Figure 2 Delayed white muscle disease in a 4 week old lamb



Weaner ill thrift (or selenium-responsive ill-thrift)

Weaner ill thrift is characterised by poor growth rates and decreased wool production.

It may not always be associated with WMD but usually occurs in the same districts and not necessarily on properties where WMD occurs.

Production responses in wool growth have been around 5 to 10 per cent with selenium supplementation, with the effect carrying on for 2 to 3 seasons.

This carryover effect may be due to the increased bodyweight in young sheep resulting from supplementation.

Selenium-responsive scouring

Selenium responsive scouring may occur on properties where selenium-responsive weaner ill thrift occurs.

Selenium supplementation is not always the answer for weaner ill thrift. Where WMD has been seen in Western Australia, many trials of sheep of all ages in all seasons have failed to demonstrate any worthwhile bodyweight or production responses to selenium.

Ewe infertility

Ewe infertility has been seen in New Zealand and on a few properties in the New England district. On these properties the selenium deficiency results in the death of the embryo about 35 days after conception.

This shows up as an increase in the number of dry or barren ewes in the flock. In New South

Wales ewe infertility due to selenium deficiency has been recognised only in the New England area, and then only on properties where WMD occurs.

Diseases resembling selenium deficiency

There are several conditions which have been confused with selenium deficiency.

Lameness can be caused by arthritis, foot diseases, spinal abscesses and other diseases. Arthritis is often associated with swollen joints, whereas in WMD there is no swelling. Arthritis may be unilateral or bilateral. WMD lameness is usually bilateral.

Weaner nutritional myopathy is another form of WMD. It is seen in some areas in young sheep grazing stubble or rank, dry feed or in young sheep being maintained on hay and grain rations.

This condition is associated with a vitamin E deficiency. Signs of disease include weakness and a staggering gait, frothing from the mouth and nostrils, inability to stand and paddling on the side.

The condition is difficult to distinguish from selenium-deficient WMD on post-mortem examination, requiring an analysis of blood and liver samples for vitamin E and selenium levels.

Some of these animals may show no obvious changes on gross examination, but microscopically will show severe changes in the muscle.

In other cases the muscle takes on a pale 'fish-flesh' appearance. Vitamin E deficiency is usually associated with a lack of green feed.

On the Darling River floodplains a disease previously called WMD has now been shown to be due to sheep grazing on plover plains daisy.

Muscle lesions have also been seen in cases of exertional rhabdomyolysis caused by driving sheep over long distances at a fast rate, usually with motorbikes.

Ill thrift can be caused by many conditions, the most common being poor nutrition. Other causes include internal parasites, eperythrozoonosis, pneumonia, coccidiosis and scabby mouth.

Scouring in young sheep can have several other causes besides a selenium deficiency. These include internal parasites, coccidiosis, changes in diet (especially after a drought), and bacterial and viral infections of the gastrointestinal tract.

Diagnosis of selenium deficiency

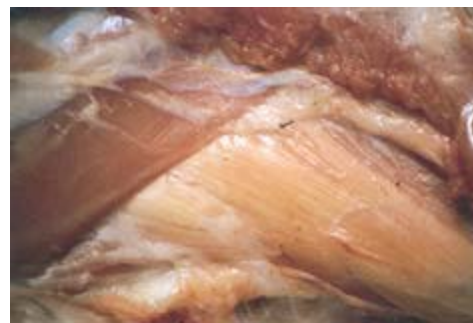
Selenium deficiency is diagnosed by post-mortem examination or a blood test or responses to selenium supplementation in on-property trials.

Congenital or delayed WMD in the lamb is usually detected at post mortem, but for an accurate diagnosis an examination of muscle, liver and blood samples is required. Vitamin E deficiency can cause similar lesions. Vitamin E deficiency has been diagnosed in flocks over much of New South Wales.

Weaner ill thrift and scouring associated with selenium deficiency is diagnosed by a careful examination of the flock to eliminate other causes of ill thrift or scouring and may include a blood test to indicate evidence of low blood selenium. It is confirmed by responses to selenium supplementation.

Ewe infertility due to selenium deficiency has occurred only on properties where congenital white muscle disease has been seen. The problem is embryo mortality, as shown by ewes mating to the ram, not returning to service, but not lambing. Diagnosis involves an investigation to determine where the reproductive wastage is occurring in the flock and the elimination of other causes of infertility.

Figure 3 Leg muscle of a WMD-affected lamb: Note the normal dark red muscle and the pale creamy-white affected muscle.



Treatment

The treatments for diseases associated with selenium deficiency are the same as those used in prevention and control programs.

Prevention

Graziers should check with their local veterinarian to confirm that they have selenium deficiency disease or a selenium-responsive ill thrift. Once the disease is confirmed, your local veterinarian can design a program to prevent the disease in stock on your property.

Table 1 Selenium deficiency diseases in sheep in NSW

Disease	Age affected	Clinical signs	Comments
Congenital white muscle disease	Newborn lambs	Sudden death, lameness, reluctance to move	On heavily supered, clover dominant pastures in lush seasons
Delayed white muscle disease	1 to 3 months	Lameness, reluctance to move, 'paralysis'	On heavily supered, clover dominant pastures in lush seasons
Weaner ill thrift	Weaners	Poor growth and wool production	Not necessarily associated with WMD
Scouring	Young animals	Scouring	Occurs on selenium-responsive ill thrift properties
Infertility	Ewes	Dry ewes due to embryonic mortality	Occurs only on WMD properties

Prevention programs are outlined in Table 2. Selenium can be given alone as a drench, in combination with worm drenches or vaccines, as an injection, or as a pellet (adult sheep only).

Dose rates are important. The dose rate is **1 mg of active selenium per 10 kg liveweight**; that is, 1 mg for young lambs and 5 mg for adult sheep. An overdose of selenium is toxic, therefore take care to avoid overdosing.

When dosing sheep with selenium, keep these points in mind.

- Always read the label to determine the concentration of selenium. Dosing must be accurate: there is little room for error.
- When treating adult sheep, take care to ensure that the adult dose is given. The dose in clostridial vaccines is sufficient for lambs, but not for ewes.
- Selenium pellets cannot be given to lambs under 12 weeks of age. The pellet will not stay in the animal until the rumen is developed.
- Selenium pellets should be used on properties where selenium-responsive ill thrift or infertility has been diagnosed. They will provide adequate levels of selenium for longer periods than other methods of prevention.
- The use of drenches or vaccines containing selenium should fit in with the drenching or vaccination program on the property.
- If selenium is incorporated with a worm drench, make sure that the worm drench will be effective; that is, ensure that anthelmintic resistance is not a problem on your property.
- Selenium pellets will provide protection for 15 to 36 months; selenium incorporated in

drenches and vaccines will provide adequate selenium levels for about 8 weeks.

There is a summary of methods of administering selenium to sheep in Table 3. In all cases, take care to ensure that the correct dose of selenium is given.

Selenium toxicity

An overdose of selenium can be toxic. An oral dose of 10–15 mg of selenium is known to kill lambs. An injection of 5 mg selenium can be lethal to lambs. Stressed animals are most susceptible. Selenium toxicity may be acute or chronic. Signs of selenium toxicity include:

- respiratory distress
- restlessness
- blindness
- staggering
- head pressing
- anorexia
- salivation
- abdominal pain
- watery diarrhoea
- convulsions
- paralysis, and
- death.

If you suspect selenium toxicity, seek veterinary advice immediately. Treatment may be attempted, however the prognosis is guarded.

Table 2 Programs to prevent selenium deficiency in sheep

Disease	Treatment
White muscle disease	5 mg* of selenium to ewes 1 month pre-lambing or selenium pellet given every 2 years 1 mg* of selenium to lambs at lamb marking
Selenium-responsive ill thrift or scouring in weaners	2 doses of 1 mg* of selenium per 10 kg liveweight at intervals of 2 to 3 months or selenium pellet given at 3 to 4 months of age
Infertility in ewes	5 mg* of selenium to ewes 1 month prior to joining or selenium pellet given every 2 years

*1 mg of selenium is equivalent to varying amounts of selenium compounds. Always check with your veterinarian to ensure the correct doses of selenium are being given.

Table 3 Methods of administering selenium to sheep

Method	Comment
Selenium drench	An oral drench. Ensure this is mixed thoroughly before use.
Combined with clostridial vaccine (3-in-1 +Se, or 6-in-1 +Se)	The selenium dose in these products is the lamb dose and will not be effective in preventing selenium deficiency in adult sheep. Check the dose carefully and shake well before use.
Combined with worm drench (liquid)	The selenium in these products is in the correct concentration to accurately dose to the weight of the animal, but always check the label to ensure the correct dose of selenium is administered, particularly with lambs. Shake well before use.
Combined with worm drench and cobalt (capsule)	Be careful to use the correct product for the weight of the sheep. Sheep should be at least 20 kg (3 to 4 months of age). Ensure the product is effective in controlling worms on your property.
Selenium pellet	Sheep should be at least 3 to 4 months of age. You may require a grinder*.
Selenium feed additive	This is available as a powder to be added to feed. Some products may also be added to water.
Selenium slow release injection	Be extra careful with dosing, as the label dose may not be accurate for your needs. Consult a veterinarian before administration. It lasts for approximately 24 months.
Selenium + vitamin B12 injection	Be extra careful with dosing as the label dose may not be accurate for your needs. Consult a veterinarian before administration.
Selenium as fertiliser	Selenium may be added to correct soil deficiencies. Application rate must be accurate.

Notes: Selenium is available as a fertiliser. Application rate must be accurate. Keep in mind that selenium is a heavy metal, therefore environmental contamination must be avoided. This may be a convenient way to prevent selenium deficiency. Seek advice from your agronomist. *In some areas grinders may not be necessary.

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