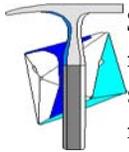


# Selenium Effects on South Dakota Livestock Production

## What is Selenium?

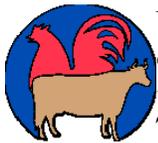


Selenium occurs naturally in various mineral forms in nearly all parts of the world and is a necessary part of a healthy diet for humans and animals. Some areas of the world supplement selenium in human and animal diets, as locally produced food and feed does not contain sufficient quantities to meet nutritional needs. However, an over abundance of selenium in human and animal diets can cause severe toxic effects.

Most of western South Dakota is composed of sedimentary marine shales that were developed when an inland sea covered South Dakota (see map here- \*.pdf format). Selenium is often associated with marine shales and therefore South Dakota has areas of high selenium concentration in soil and water. Soils that are high in concentration of selenium are referred to as "seleniferous" soils. Plants growing in those soils will absorb selenium from the soil in the form of selenite ( $\text{SeO}_3$ ) and selenate ( $\text{SeO}_4$ ). Selenate is said to be the most common form of selenium in the state due to the chemical properties of soils in the western portion of the state.

Selenium toxicity is commonly referred to as selenosis. Selenosis was first documented in 1856 near Ft. Randall in South Dakota. A physician with the U.S. Cavalry reported horses experiencing hair, mane, and tail loss and sloughing of hooves. Over the next 75 years similar reports from livestock owners led to a cooperative investigation by the South Dakota and Wyoming Experiment Stations and US Department of Agriculture. It was found that the symptoms experienced by livestock were the result of consuming forage containing high concentrations of selenium.

## How do I Know if Selenium is a Problem on my Farm or Ranch?



Visually there are several things to look for that will indicate that forage or water may contain toxic concentrations of selenium. Several plant species have been found to thrive in seleniferous soils and are referred to as selenium indicator plants. Three species of these plants are found in South Dakota, Twogrooved poisonvetch (*Astragalus bisulcatus*)<sup>§</sup>, Racemed poisonvetch (*Astragalus racemosus*)<sup>§</sup>, and Prince's plume (*Stanleya pinnata*)<sup>§</sup>. These plants are reasonably reliable indicators of areas of high selenium concentration in soils.

Areas that are saline or have saline seeps have the potential to have high levels of selenium in forage and water. Not all saline areas will be seleniferous nor will all saline water contain high levels of selenium. Areas where saline seeps discharge water high in selenium have been documented in western South Dakota by the Department of Agriculture.

Another indicator is to observe livestock that may or may not be exposed to toxic levels of selenium. Research has shown that horses will begin to lose the long hairs in the mane and tail from high

doses of selenium. Cattle may have a rough hair coat and exhibit symptoms such as reduced reproductive performance, poor weight gain, or hoof or horn changes or loss. Lameness can result from advanced cases of selenosis. Cattle that have been exposed to high levels of selenium have been observed to graze on their knees, as the front feet become sore.

Observations of indicator plants and saline areas provide a producer with an indication of a problem with selenium but the only way to determine if a threat to livestock exists is to sample the water and forage and have it tested by a reputable laboratory. The O.E. Olsen Biochemistry Laboratory on the campus of South Dakota State University provides analysis of forage and water for a fee, as do many other public and private laboratories. A laboratory analysis of water and forage provide a livestock producer with detailed information to make management decisions regarding a livestock operation.

Forage or feed suspected to be high in selenium can be analyzed to determine total selenium. Research has shown that forage or feed that contain 2-5 ppm selenium poses a marginal threat to livestock. Livestock that are continually fed forages containing marginal levels of selenium may experience chronic selenium toxicity. Forage above 5 ppm selenium is said to cause acute toxic conditions in livestock and should be avoided.

Water supplies in seleniferous areas are also a source where toxic levels of selenium can be found. Livestock that use stock dams, streams, or seep discharges in a seleniferous area for a water supply are at risk of chronic or acute selenium toxicity. Livestock should be excluded from water supplies that have a selenium concentration of 0.5 ppm or greater.

### **What should I Do If I have a Potential for Selenium Toxicity?**



Excluding the livestock from water or feed that contains toxic levels of selenium is a priority. Adverse effects of selenium will usually reverse if the source of selenium is reduced and the toxicity has not progressed to a point where it is irreversible.

Seleniferous forages usually occur in a localized area. If these areas can be identified and livestock can be excluded, loss of livestock productivity can be avoided. If feed such as hay or other feed crops have been determined to be high in selenium the feed can still be used if it is blended with feed known to be low in selenium.

Managing selenium in livestock production means that a consideration of the total selenium intake is considered. Selenium can be consumed by livestock in water and feed supplies. Controlling selenium intake will reduce the risk of selenosis and avoid undue economic loss.

<sup>§</sup>Photographs provided courtesy of Jim Johnson, South Dakota State University.