

Trace Minerals and their Role in Reproduction

Diets of beef cattle need to supply essential nutrients to sustain life and maximise productivity. Essential nutrients are classed as energy, protein, water, vitamins and minerals. The once principle producers and nutritionists alike work off is that if sufficient amount of all nutrients but one are supplied, the levels of that particular nutrient will limit the animal's performance.

With that in mind, this discussion will focus on an important but often overlooked component of ruminant diets, being the trace mineral component. Trace minerals hold critical roles in maximising reproductive efficiencies in breeding cattle. Both clinical and subclinical deficiency of one or several essential trace minerals can limit conception rates, return to oestrus, cow recovery after calving, calf survivability and bull performance.

The Four Season Company has recognised the need to include significant amounts of trace minerals, and other nutrients, in an easy to access lick block to increase reproductive efficiencies in northern breeding stock. The result has been the development of "Cow and Calf". By feeding these essential nutrients Four Season Company have already successfully increased reproductive parameters in preliminary trials in northern Australia.

The following information will briefly outline essential trace minerals and their role in reproduction:

Copper

Copper was first shown to be an essential TM in 1928. Copper deficiency in cattle can occur through low copper concentrations in soils and pastures. Copper is an essential element that activates several enzyme systems related to the reproductive functions of cattle. The physiological roles of copper include, cellular respiration, bone formation and connective tissue development along with correct brain formation and function.

Low copper content in cattle diets causes embryo loss and inhibits embryo implantation. Prolonged copper deficiency results in low fertility because of delayed or suppressed oestrus, prolonged post calving periods, abortions and in extreme cases, foetal death.

Selenium

Selenium was first shown to be an essential nutrient in 1957. Like most TM's selenium deficiency is caused by the lack of available selenium in the soil and pasture. Selenium is essential for conception in ruminants. Selenium is an integral component of glutathione peroxidase, which is the general name of an enzyme family whose main biological role is to protect an organism from oxidative damage. These types of enzymes are commonly referred to as antioxidants. The antioxidant activity of the selenium enzymes play an important role in maintaining the integrity of the cell and the structures within the cell, and may act through this mechanism to protect the early foetus from mortality due to oxidative damage.

Inadequate selenium in the tissues of cattle can result in high embryonic losses in the first 30 days of pregnancy as well as white muscle disease in calves. Cows on selenium deficient diets will have lower fertility and an increased incidence of retained placenta after calving.

Zinc

Zinc, determined to be an essential trace mineral in 1934, is found in high concentrations in multiple parts of the body including the liver, bone, kidney and muscle. This is indicative of its numerous functions in the ruminant.

The foetus needs zinc for normal growth and development, while the young female requires zinc to reach sexual maturity and trigger first oestrus. Zinc is a component of many enzyme systems involving energy metabolism, protein metabolism, epithelial tissue integrity, cell division and repair as well as vitamin A and E transport and utilisation.

Zinc deficiency affects growth rates in calves and heifers, skin condition, reproduction and skeletal development. A lack of zinc in bulls can severely alter development and function of the testes as well as decrease libido and sperm quality and quantity.

Manganese

Manganese, first thought to be an essential TM in 1931, is a mineral that is often overlooked in cattle diets or confused with the macro mineral magnesium. Manganese is vital to the utilisation of carbohydrates. It is also an antioxidant, activating enzymes that work within cells to destroy damaging free radicals.

Manganese also holds a very important role in reproduction and that is to stimulate the oestradiol secretion by the conceptus (foetus + placenta) as the signal for pregnancy recognition. Without the recognition of pregnancy the cow may fail to realise she has come into calf, which will result in early embryonic mortality before day 14.

Poor supply of manganese has been associated with retarded bone growth in calves and reproductive failure in females through impaired ovulation.

Cobalt

Cobalt is required by the microorganisms ever present in the rumen to synthesize vitamin B12. Vitamin B12 is an essential part of enzyme systems that are important to basic metabolic functions. The major function of B12 is to activate enzyme systems that utilise energy. It also assists in the formation of proteins from amino acids and in fat metabolism.

B12 deficient cattle fail to convert volatile fatty acids efficiently to energy, resulting in a severe energy deficiency, poor growth and poor general health.