

Organic trace mineral supplementation

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Worldwide dairy cow fertility has been declining in high genetic merit Holstein Friesian herds for the past 20 years and research has shown that this infertility is largely due to a failure of cows to ovulate. The causes of this failure and subsequent infertility, however, are complex and multifactorial and can not be evaluated in isolation of other diseases and disorders.

In a bid to reduce the incidence of disease and disorders around calving, and to boost fertility, producers are focusing their attention on the energy and protein status of the cow, particularly at the point of insemination and, increasingly, around the calving period. But they should also look at the mineral and vitamin status of the cow. Macro minerals, trace elements and vitamins play a vital role in preventing production diseases and disorders around calving, particularly milk fever, mastitis, lameness and retained placenta.

These conditions all have a negative impact on ovulation and cow fertility and, therefore, their prevention offers potential improvements to fertility later in lactation.

The form that minerals and vitamins are fed during the dry period can have a significant effect on fertility. Research has shown that feeding organic forms of minerals such as Alltech's Bioplex organic trace minerals and Sel-Plex has shown improvements in conception rates and days to first service versus feeding inorganic forms of minerals.

Mastitis

Vitamin E and zinc are both effective for mastitis prevention, particularly during the first weeks of lactation, through enhanced antioxidant function and keratinisation of the teat canal. The average incidence of mastitis in UK herds is around 39.1% and the average cost of a single case of mastitis is reported as £177 (€269), ranging from £149 (€227) for a mild case to £1,709 (€2,605) for a fatal case.

The dry period is a critical period for the acquisition of new Gram negative intra-mammary infections, with more than 60% of all new infections occurring at this time. Clinical mastitis caused by Gram negative bacteria has a negative effect on fertility.

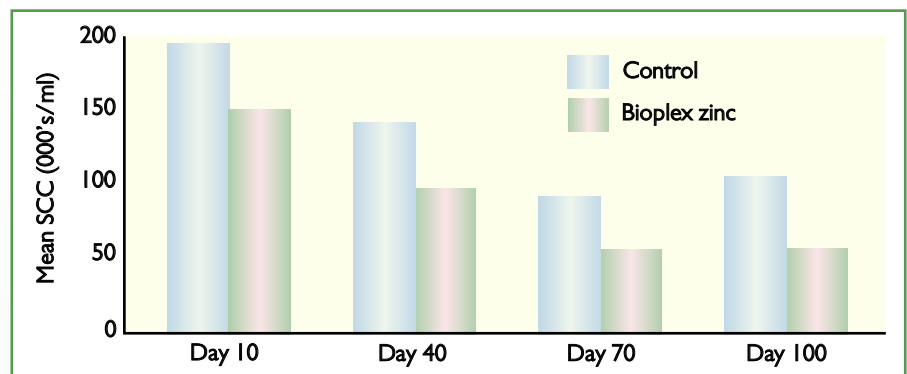


Fig. 1. Effect of zinc source on SCC (Popovic, 2003).

Zinc is an essential trace mineral found to be an integral component of more than 300 enzymes in metabolism and is known to be involved in a number of healing processes in the dairy cow.

Zinc is also involved in keratinisation, the process that lines the teat canal with keratin, a natural chemical and physical barrier to bacteria gaining entry to the udder.

About 40% of the keratin lining is removed at each milking and so requires constant

regeneration between milkings. Zinc also has a role in immune function and the inclusion of supplemental organic Bioplex zinc in the diet has been shown to help reduce the incidence of mammary infections and lower somatic cell counts.

Zinc oxide and zinc sulphate have similar bioavailabilities in ruminants and, although the precise mode of action is yet to be fully identified, organic forms of zinc, such as Bioplex zinc appear to be better absorbed and retained by the animal.

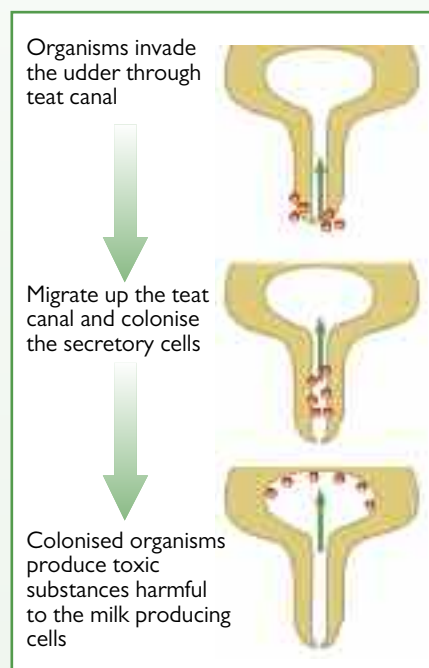
Trials by Popovic 2003, replacing 33% of the supplemental inorganic zinc sulphate with organic zinc for 45 days pre-calving until 100 days post calving showed that cows receiving the organic zinc had significantly lower SCC by day 10 of lactation and at the end of the trial.

By replacing 50% of the supplemental inorganic zinc with organic Bioplex zinc cows had significantly fewer new mastitis cases and other research found that replacing 30% of the inorganic copper, zinc and manganese for six weeks pre-calving until 305 days of lactation resulted in a 6.5% increase in milk yield and a 34% reduction in SCC.

The effects of vitamin E in dairy cow nutrition have also been extensively studied. Feeding 1,000 IU/day from 60 days pre-calving, then 4,000 IU/day from 14 days until calving followed by 2,000 IU/day for 30 days post calving resulted in an 80% decrease in clinical mastitis and a 60% reduction in intra-mammary infections.

Feeding supra-nutritional levels of vitamin E and incorporating a proportion of the sup-

Fig. 2. Process of mastitis infection.



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 plemental zinc in an organic form in the pre and post calving period may help reduce the new infection rate of mastitis and SCC. As mastitis at calving is a risk factor in poor fertility, I believe that this is one nutritional strategy to improve fertility.

Lameness

Lameness in dairy cattle during lactation is often the result of 'insults' to the hoof that occurred prior to calving and zinc and biotin are implicated in improving keratinisation of the hoof and prevention of this disease.

Organic forms of zinc, such as Bioplex zinc, are retained better than inorganic sources and may provide greater benefit in disease prevention.

The incidence of lameness has been steadily increasing during the past 20 years, to today's average of 24 cases per 100 cows. Evidence found in heifers supports the hypothesis that events associated with calving weaken the connective tissue of the hoof, leading to increased susceptibility to clinical lameness associated with sole ulcers and white line disease. The total average cost of a single case of lameness is around £171 (€260) and the resulting reduced fertility costs an additional £46 (€70).

In trials, cows fed Bioplex zinc had healthier hooves, due to better absorption and utilisation of the organic forms of the mineral. Dairy cows fed additional Bioplex zinc for a 12 month period exhibited fewer cases of heel horn erosion, foot rot, digital dermatitis and laminitis with a lower incidence of sole ulcers and white line separation.

Biotin, a member of the B vitamin group, is also an essential nutrient in the formation of keratin. Biotin is produced in the rumen by microbial synthesis and its production can be limited by acidic conditions, such as those occurring in early lactation with high concentrate feeding.

In trials, supplementation with biotin, at a rate of 20mg/day, reduced the incidence of lameness, with only 24% of cows having sole haemorrhaging versus 50% in a 14 month long study. Heifers fed biotin in this trial also

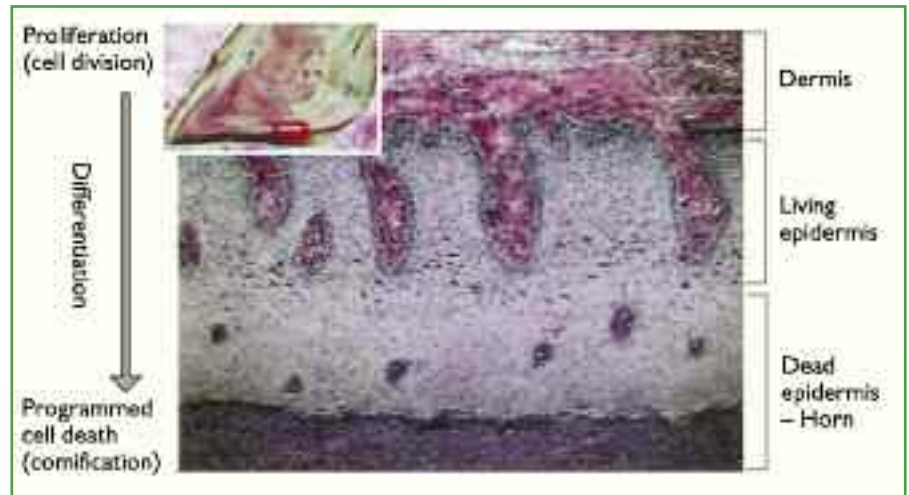


Fig. 3. Bovine hoof (micrography) (Mulling, 2005).

had fewer days to conception (108 vs. 169 days) and less services per conception (1.50 vs. 2.96) than the control animals.

Retained placenta

Retained placenta (RP) can be reduced by preventing milk fever and by also ensuring that the selenium status of the cow is adequate. Selenium yeast is known to have higher retention in tissues and may play an important role in ensuring sufficient selenium is available to the cow for reduction of disease.

The incidence of retained placenta in herds averages around 4% and appears to be worsening. The disorder lengthens the calving interval by 22 days, accounting for £45 (€68) of the total average cost of £265 (€404) per case.

Cows with RP also have an increased risk of metritis within a month of calving and longer days to first service and services per conception. In fact there are many factors associated with increasing risk of RP, including dystocia, twinning, stillbirth, ketosis and milk fever.

A study revealed that cows supplemented with Sel-Plex had no cases of RP, whereas the control animals had a 17.4% incidence.

Another trial revealed similar results with control cows showing 20% incidence of RP with a low selenium diet against 0% in the Sel-Plex supplemented animals. The number of services per conception in the selenium fed cows also tended to be lower (1.54 vs. 2.05).

A review of 13 studies also showed that where selenium was administered or fed only 10% of cows had RP versus 32% of the control animals. Numerous studies have shown that the retention of the selenomethionine form, as found in Sel-Plex, is greater than that of inorganic sources.

The use of inorganic selenium may prevent severe selenium deficiencies, but supplementation with Sel-Plex could prove beneficial in providing enhanced selenium status and antioxidant function at times of greatest stress and disease challenge, such as during the time around calving.

Clearly there is a role for minerals, trace elements and vitamins in the prevention of production disorders and diseases at and around calving.

Mastitis, lameness and retained placenta all have a negative impact on the subsequent fertility of the cow. Feeding a ration correctly balanced with vitamins and minerals, plays a key role in safeguarding reproductive performance. ■