



## How minerals will help your bull be more fertile

Many of the factors that influence the age of puberty and fertility in bulls may be impacted by management. The effects of mineral supplementation on bull fertility have been well documented. For example, dietary supplementation of zinc

and copper is involved in sexual maturity and reproductive development bulls. Yearling bulls fed with higher concentrations or organic forms of zinc, copper, and manganese tended to reach puberty earlier. Interestingly, although we discuss requirements of trace mineral provide for growing and finishing cattle, gestating cows, and cows in early lactation, there are no specific requirements defined for peripubertal or mature bulls and the particular impact of the mineral dietary supplementation in bull sperm quality and potential fertility.

Some studies have shown that dietary supplementation of minerals impact the reproductive status of the bull. For example, yearling bulls fed with organic forms of zinc, copper, and manganese at higher concentrations than inorganic forms tended to mature earlier. Interestingly, the form of the mineral does matter. The solubility and bioavailability of basic copper chloride and zinc hydroxychloride were improved over sulfate or other organic sources of trace minerals. Dietary supplementation of zinc, copper and manganese in mature bull results in a positive association between zinc concentration in the liver and sperm concentration and some sperm attributes required for fertility. In peripubertal bulls, zinc and copper supplementation have improved the average daily gain. But interestingly, the reproductive quality as assessed by pre-fertility checks known as breeding sound exams are not affected by mineral supplementation. This might speak to a lack of investigation of the appropriate sperm trait rather than a lack of impact. Remember, motility is poorly correlated to fertility and most breed soundness exams only focus on sperm motility.

At a reproductive level, bulls that received zinc and copper supplement show reduction of certain sperm defects (termed sperm morphology), better sperm energetic metabolism and longer sperm survival and oxidative stress resistance after 3 h incubation. Incubation of sperm post-thaw tests how robust the sperm might be in the reproductive tract. Another study has shown that iodine dietary supplementation does not affect body weight and breeding sound exam of bulls. This is interesting because iodine is an essential micronutrient that plays an indirect crucial role in male reproduction by changing thyroid function and the antioxidant status. Generally, bulls supplemented with dietary iodine have improved iodine content in blood and seminal plasma, plus the concentrations of testosterone and thyroxine hormone are more optimized. Additionally, blood antioxidant status and sexual behavior is improved in animals receiving iodine supplement versus those without supplementation. At reproductive level, sperm attributes such as viability, membrane integrity, motility, and energy status are improved in iodine-supplemented bulls, possibly enhancing the bull fertility potential.



It is interesting to note that numerous investigations support the finding that trace mineral source and supplementation do not greatly impact mature bull weight gain, sperm quality and fertility parameters. It may be that trace mineral needs are grossly overestimated for bulls and the feedstuffs. They might receive sufficient mineral content without supplementation.

From a physiological point of view, mature bulls with adequate liver storage of minerals may not receive any benefit of trace mineral supplementation and subsequent fertility. However, the increased pressure on yearling bulls to reach puberty and pass a breeding soundness evaluation by one year of age has become commonplace in beef producers. A quality dietary regime and mineral supplementation will ensure adequate nutrition to grow and produce adequate sperm for optimal fertility which is crucially important to herd fertility. In conclusion, it seems that bull trace mineral homeostasis mechanisms are incredibly effective, and mineral supplementation of mature and peripubertal bulls optimally fed did not significantly improve measurements of fertility. However, bulls exposed to high load breeding or in environments with limited diet and poor nutrition might respond differently to specific mineral dietary supplementation.

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1. Geary, T. W., Waterman, R. C., Van Emon, M. L., Ratzburg, C. R., Lake, S., Eik, B. A., Armstrong, D. R., Zezeski, A. L., & Heldt, J. S. (2021). Effect of supplemental trace minerals on standard and novel measures of bull fertility. *Theriogenology*, 172, 307–314.
2. Srivastava, R., Tiwari, S., Banakar, P. S., Bhakat, M., Mani, V., Mohanty, T. K., & Mondal, G. (2022). Iodine Supplementation Improved Antioxidant Status, Hormonal Status, Sexual Behavior, and Semen Production Performance of *Bos indicus* Bulls Under Tropical Climatic Condition. *Biological trace element research*, 200(11), 4690–4703.
3. Arthington JD, Corah LR, Hill DA. Case Study: the effect of dietary zinc level and source on yearling bull growth and fertility. *Prof Anim Sci* 2002; 18: 282e5.
4. Geary TW, Kelly /wL, Spickard DS, Larson CK, Grings EE, Ansotegui RP. Effect of supplemental trace mineral level and form on peripubertal bulls. *Anim Reprod Sci* 2016; 168: 1e9.
5. Caramalac LS, Netto AS, Martins PGMA, Moriel P, Ranches J, Fernandes HJ, Arthington JD. Effects of hydroxychloride sources of copper, zinc, and manganese on measures of supplement intake, mineral status, and pre- and postweaning performance of beef calves. *J Anim Sci* 2017;95:1739e50.
6. Caldera, Weigel EB, Kucharczyk VN, Sellins KS, Archibeque SL, Wagner JJ, Han H, Spears JW, Engle TE. Trace mineral source influences ruminal distribution of copper and zinc and their binding strength to ruminal digesta. *J Anim Sci* 2019; 97: 1852e64.