The Pharma Innovation Journal 2017; 6(12): 517-522

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating 2017: 5.03
TPI 2017; 6(12): 517-522
© 2017 TPI
www.thepharmajournal.com
Received: 20-10-2017
Accepted: 21-11-2017

K Sethy
Assistant Professor, Department of Animal Nutrition, C.V.Sc & A.H, OUAT, Bhubaneswar, Odisha, India

P Dwibedy
MVSc Scholar, Department of Animal Nutrition, C.V.Sc & A.H, OUAT, Bhubaneswar, Odisha, India

V Dhaigude
MVSc Scholar, Department of Animal Nutrition, C.V.Sc & A.H, OUAT, Bhubaneswar, Odisha, India

Ranu Dash
MVSc Scholar, Department of ARGO, C.V.Sc & A.H, OUAT, Bhubaneswar, Odisha, India

PD Adhikary
MVSc Scholar, Department of Animal Nutrition, C.V.Sc & A.H, OUAT, Bhubaneswar, Odisha, India

RD Mukherjee
MVSc Scholar, Department of Animal Nutrition, C.V.Sc & A.H, OUAT, Bhubaneswar, Odisha, India

V Vaidantika
MVSc Scholar, Department of Animal Nutrition, C.V.Sc & A.H, OUAT, Bhubaneswar, Odisha, India

P Priyadarshinee
MVSc Scholar, Department of Animal Nutrition, C.V.Sc & A.H, OUAT, Bhubaneswar, Odisha, India

Correspondence
K Sethy
Assistant Professor, Department of Animal Nutrition, C.V.Sc & A.H, OUAT, Bhubaneswar, Odisha, India

Strategic use of minerals to augment production and reproduction in animals

K Sethy, P Dwibedy, V Dhaigude, Ranu Dash, PD Adhikary, RD Mukherjee, V Vaidantika and P Priyadarshinee

Abstract
Minerals play an important role in various bodily functions that are necessary to sustain life and maintain optimal health and thus are essential nutrients. The amount of minerals present in the body and their metabolic roles varies considerably. Minerals are required for a number of functions like normal body maintenance and function, milk production, fetal development and reproduction Mineral imbalances in soil and forage have long been held responsible for low production and reproductive problems among ruminants. Calcium is used in the formation and maintenance of bones and teeth. P deficient cattle may go for 2-3 years without producing a calf or do not come in estrus. Cattle deficient in salt often eat dirt, manure, and urine in an attempt to satisfy their appetite for salt. Zinc deficiency may lead to depressed feed intake, reduced growth rate, abnormal hair coat and various skin lesions. Copper deficiency delayed onset of puberty, repeat breeding, low conception, early embryonic mortality and increased incidence of retention of placenta.

Keywords: animal, mineral, production, reproduction

Introduction

Dairy animals most commonly suffer with the nutritional deficiencies due to high production and deficient feeding, ultimately leading to poor reproductive performance. Animals require the proper balance of water, energy, protein, minerals and vitamins to achieve optimal levels of production. Energy and protein are the major nutrient requirements of farm livestock. Dietary insufficiency of either or both is the major cause of depressed animal performance. For efficient utilization of energy and protein, it is important that mineral requirements are met. To support normal life processes, all forms of life require inorganic elements or minerals, Furthermore, all animal tissues and all foodstuffs contain minerals in widely varying amounts and proportions. The lack of sufficient energy and protein is often responsible for suboptimum livestock production. But some time, it has been observed that cattle and buffaloes deteriorate in spite of the fact that there is abundant feed supply. Minerals are inorganic element that originate in the earth and cannot be made in the body. Unlike other nutrients, minerals can not be synthesized by living organisms; therefore, animals must acquire adequate amounts of required elements from their environment if survival and production goals are to be maintained. All the minerals in the animal diet come directly from plants and water. However, the mineral content of water and plant foods varies geographically because of the variations in the mineral content of the soil from region to region. The amount of minerals present in the body and their metabolic roles varies considerably.

Adequate intake of forages by grazing animals is essential in meeting mineral requirements. Factors that reduce forage intake (e.g. low protein, high degree of lignification) also reduce total mineral consumption. The concentration of minerals in plants is dependent upon interactions among a number of factors including soil type, plant species, stage of maturity, dry matter yield, grazing management and climate (Poland, 2002) [1].

Mineral imbalances (deficiencies or excesses) in soils and forage have long been held responsible for low production and reproductive problems among ruminants in the tropics. Mineral deficiencies in all categories of animals (low yielding to high yielding), which are stall fed have also been observed due to lower content of essential minerals in feed and fodder fed to these animals. Wasting disease, loss of hair, depigmented hair, skin disorders, non-infectious abortions, diarrhea, anemia, loss of appetite, bone abnormalities, grass tetany, low fertility and ‘pica’ are the clinical signs often suggestive of mineral deficiencies throughout the world.

Pica is an abnormal appetite, which can be characterized by chewing of soil, bones, rags, cloth, wood and other objects (Lall, 2000) [2]. Minerals constitutes almost 3% of a cow's body weight is comprised of minerals (Table 1).

Table 1: Concentrations of different minerals in cattle.

Minerals	Concentration
Calcium (Ca)	1.33%
Phosphorus (P)	0.74%
Potassium (K)	0.19%
Sodium (Na)	0.16%
Sulfur (S)	0.15%
Chlorine (Cl)	0.11%
Magnesium (Mg)	0.04%
Iron (Fe)	0.01%

The required minerals are divided into major (macro) and trace (micro) minerals. The major minerals include sodium, chlorine, potassium, calcium, phosphorus, magnesium and sulfur. Trace minerals are required at much lower levels than the major minerals but are just as essential. Required trace minerals include zinc, copper, selenium, manganese, iron, nickel, cobalt, molybdenum and iodine (Davis, 1999) [3]. Minerals are required for a number of functions, e.g. normal body maintenance and function, milk production, fetal development and reproduction.

The general functions of minerals are to:

1. Give strength to the skeletal structure,
2. Serve as a component of protein,
3. Activate enzyme systems,
4. Control fluid balance, osmotic pressure and excretion,
5. Regulate acid-base balance

Life systems that are dependent on specific minerals to function normally are:

a. Immune System — Cu, Zn, Fe, Se
b. Blood Production — Cu, Fe
c. Reproduction — P, Cu, K, Mn, Zn, Mg
d. Hormone System — Fe, Mn, Zn, Cu, Mg, K
e. Energy Production — Mg, P, Mn
f. Enzyme System — Zn, Cu, Mn, Mg, Fe
g. Vitamin Production — Co

Calcium

Calcium (Ca) and phosphorus (P) are the two major elements required by the body and its requirement increases with increased milk production because of its regular drain through milk. Milk contains 1.17g Ca and 1.05g P per kg of milk. Considering the bio availability values of these elements to be about 50%, we need to supply about 2.6g Ca and 2g P in the diet per Kg of milk produced to maintain positive balance of these elements in the body. Calcium is used in the formation and maintenance of bones and teeth. It also functions in transmission of nerve impulses and contraction of muscle tissue. A dynamic system involving calcium, phosphorus and vitamin D exists to maintain a relatively stable concentration of calcium in the blood. Calcium and phosphorus are stored in bone and mobilized into the circulatory system, when dietary intake of the two minerals is adequate. Blood calcium level is not a good indicator of a dietary calcium deficiency because blood calcium is reflective of both calcium intake and calcium mobilization from bone. Because of its importance in bone structure, deficiency of calcium in young animals leads to skeletal deformities (Rickets). In older animals, fragile bones can result from extended periods of dietary calcium deficiency (Osteomalacia). Critical times to ensure that diets contain adequate calcium are during pregnancy (for proper bone growth of the fetus) and during lactation (to prevent excessive calcium mobilization from the bones of the lactating cow). Excessive mobilization of calcium from the skeletal system of the lactating cow can lead to milk fever, also known as parturient paresis or hypocalcemia. Symptoms include muscle stiffness and tremors, extreme weakness and loss of consciousness. A Common method of minimizing the risk of milk fever is to reduce calcium intake by cows for two weeks before calving. This ensures that the calcium mobilization system is functioning properly before lactation. After calving, dietary calcium is increased to meet the requirement of the lactating cow. Calcium requirements change depending on animal age and production status. Non-lactating pregnant cows require calcium at a level of 0.18 percent of total dry matter intake, while the requirement for lactating cows is 0.27 percent of total dry matter intake. Growing and finishing cattle require 0.31 percent calcium for optimal growth (Hale and Olson, 2000) [4]. When the diet contains added fat, such as when whole cottonseed is fed, the calcium requirement is increased. Calcium to phosphorus ratio is not as important for cattle as it is for other livestock, but situations where phosphorus is high relative to calcium may result in urinary calculi (stones). Calcium to phosphorus ratio should normally be maintained at a level between 1:2 and 2:1.

Phosphorus

Phosphorus works in conjunction with calcium in the formation of bone. In addition, phosphorus is a component of deoxyribonucleic acid (DNA), the molecules that make up chromosomes and control genetic inheritance. Phosphorus is also involved in the chemical reactions of energy metabolism. Phosphorus containing compounds like adenosine triphosphate and creatine monophosphate are the body’s major storage depots of readily available energy. Our tropical forages are mostly deficient in phosphorus. Under extreme P deficiency condition cattle may go for 2-3 years without producing a calf or do not come in estrus. Phosphorus is often deficient in forages for lactating cows with superior milking ability. Phosphorus is high in oilseed meals (soybean and cottonseed meal) and also fairly high in grains; so, when diets contain substantial amounts of these ingredients, supplementation is usually not needed. Phosphorus is one of the structural components of the skeletal system and levels build up when cows are grazing lush forages that contain phosphorus at levels above requirements. Some of the phosphorus in bone can be mobilized during early lactation to overcome shortfalls in intake, but prolonged dietary deficiency has been reported to result in depressed reproductive efficiency and milk production.

Magnesium

Magnesium is an activator of many metabolic enzymes. These enzymes control reactions that range from the breakdown of glucose for energy to the replication of DNA, which is necessary for cell division. The most common problem associated with magnesium deficiency is grass tetany, observed most frequently in the early spring. Grass tetany results from the consumption of lush forage, which has low levels of magnesium, Symptoms include frequent urination, erratic behavior and convulsions. If left untreated, death can occur within several hours. Cattle need about 0.04 to 0.1

percent magnesium in the dry matter of their ration (Hale and Olson, 2000) [4]. Supplementation with magnesium oxide is recommended for 30 days prior to calving and during the first three months of lactation.

Sodium and chloride

The requirement for sodium and chlorine is commonly expressed as a salt requirement. Sodium and chlorine are major electrolytes found in body fluids and there is very little storage. Because of this, cattle will develop deficiencies rapidly and should have constant access to salt or a supplement containing salt. Both sodium and chlorine function to maintain the volume, pH and osmolarity of body fluids. Sodium is involved in muscle and nerve function. Chlorine is essential for hydrochloric acid production in the abomasum and for carbon dioxide transport. The maximum advisable level for sodium in the diet is 0.08 percent of the dry matter for dry cows and 0.1 percent for lactating cows (Hale and Olson, 2000) [4].

Salt is often fed to cattle free of choice. Cattle will usually consume more salt than needed when it is fed free-choice. Additionally, cattle eat more salt with high-roughage than with high-concentrate rations (Hale and Olson, 2000 [4]). Cattle deficient in salt often eat dirt, manure and urine in an attempt to satisfy their appetite for salt. This condition, known as pica, can be easily corrected with salt supplementation. When salt intake is below that required to meet the animal's need for sodium and chloride, the animal adjusts by conserving urine output of sodium and chloride nearly stops. A continuous low salt intake affects the health of animals through a loss of appetite and weight. Feed utilization decreases and it takes more feed per unit of gain or product produced. Animals soon develop a craving for salt. They may consume considerable amounts of dirt, wood, rocks and other materials. They will also lick manure and urine in an attempt to obtain the needed salt. Lactating animals are most susceptible to a salt deficiency because milk contains a considerable amount of sodium and chloride. Because the composition of milk is highly regulated, a deficiency of sodium or chloride in the diet will ultimately decrease milk production (McDowell, 1985) [5].

Potassium

Potassium is ubiquitous in the body of mammals because it is required in large amounts by most organ systems for normal functioning. Potassium is usually sufficient in most of the forages. Potassium is primarily present as an electrolyte in body fluids, so there is little storage. Thus, a deficiency of potassium results in nonspecific symptoms such as poor appetite, followed by thinness, reduced performance and stiffness, especially in the joints of the legs. Potassium levels of 0.6 to 0.7 percent of dry matter are necessary to promote optimal performance by growing and finishing cattle. Grain often has less than 0.5 percent potassium; therefore, potassium supplementation may become critical in certain high concentrate rations. High levels of potassium interfere with magnesium utilization, increasing the risk of grass tetany.

Sulfur

Sulfur is present in protein, certain vitamins (thiamin and biotin), enzymes and other compounds. Sulfur is a component of several amino acids that are the building blocks of protein. Diets for growing cattle should be formulated to contain 0.15 percent sulfur on a dry matter basis. Sulfur, other than that fed in the form of protein, is usually needed only when diets contain substantial amounts of non-protein nitrogen (NPN). In these situations, the ratio of nitrogen to sulfur should be maintained between 10:1 and 15:1. Substituting urea and other non-protein nitrogen compounds for natural proteins in the diet lowers the sulfur content of a ration. Certain ruminal bacteria use inorganic sulfur to make sulfur-containing amino acids and other organic sulfur compounds. Excessive sulfur interferes with the metabolism of selenium, copper, molybdenum and thiamin. Sulfur deficiency symptoms include decreased feed intake, unthrifty appearance, dullness of the hair coat and hair loss. Moderate to high dietary sulfur intake can cause a condition known as polioencephalomalacia in ruminants. Aimless wandering, blindness, muscle tremors and convulsions characterize polioencephalomalacia. Young cattle (6–18 months old) are especially vulnerable to this disease.

Trace Minerals

Trace minerals are essential to maintain animal health, production and reproduction, but are required in trace or minute amounts. When not present in sufficient quantity, these trace minerals can cause severe biological problems for the animal and economic losses for the producer. However, with trace minerals being required in such small amounts, excess supplementation can cause toxicity. Therefore, addition of trace minerals to a livestock ration should be done in concert with a professional recommendation. The minerals that are of particular concern are copper, zinc, manganese, iodine, cobalt and selenium (Saskatchewan, 1992) [6].

Zinc

Zinc is marginal to deficient in many types of forage. Zinc is a part of many important enzyme systems in the body and its deficiency leads to depressed feed intake and growth rate, an abnormal hair coat and skin lesions. An adequate zinc status is also needed for normal immune response in stressed calves. Zinc methionine, an organic zinc complex, has improved performance in feedlot cattle and in cattle grazing forages already containing adequate levels of zinc. Zinc methionine will also help overcome foot problems in cattle. Veterinarians and nutritionists recommend feeding zinc methionine as an aid in controlling and treating foot rot in beef cattle. High levels of iron in the diet interfere with the absorption of zinc and increase the dietary requirement. Zn deficiency can adversely affect the spermatogenesis, testicular growth and the development of primary and secondary sex organs in the males and all phases of reproductive process in females from estrus to parturition and lactation (Underwood, 1981) [7].

The gross abnormality in Zn deficient embryos has been observed due to differences in DNA synthesis. An effect of Zn deficiency on vitamin A metabolism is well established in ruminants as well as non-ruminants. (Prasad & Arora, 1979) [8] and is cured by Zn therapy. Zn deficiencies have been associated with abortion, fetal mummification, lower birth wt and prolonged labour as Zn plays important role in uterine lining. The effect on prostaglandin synthesis suggests that Zn deficiency have profound effect on reproductive cycle and pregnancy. Delayed puberty and lower conception rates, failure of implantation and reduction of litter size are also found in association with the zinc deficiency in feed (Kreplin and Yaremcio, 1992) [9]. Zinc has a significant role in repair and maintenance of uterine lining following parturition and early return of post partum estrus (Green *et al.*, 1998) [10]. Zn deficient animals have been shown to have lower concentrations of FSH and LH chiefly in males (Boland, 2003) [11]. Zinc deficiency in male cause atrophy of semeniferous tubule and inefficient testicular development in young ones, leading to reduced testicular size, lack of libido and can adversely affect spermatogenesis (Satish Kumar, 2003) [12].

Copper

Copper, like zinc, is marginal in many areas. It also comprises an essential part of many different enzymes in the body. Unlike zinc, however, copper is stored tenaciously in the liver and levels build up rapidly when animals are fed high levels of copper. Copper is extremely toxic to sheep, so most supplements sold to cattle producers contain little copper, primarily to prevent liability of the supplement manufacturer in case the product is fed to sheep. Copper sulfate has a higher bioavailability than copper oxide, which will affect the level of copper required in supplements. High levels of molybdenum, sulfur, iron or zinc in the diet interfere with normal copper absorption and metabolism. Copper is a vital component in many enzyme systems as cofactors. Cytochrome oxidase is a cupro-enzyme necessary for electron transport in mitochondria for energy metabolism of ATP dependent biosynthetic reactions. It is required in the body for the production of red blood cells, as it is essential for absorption and transport of iron necessary for haemoglobin synthesis (Tuormaa, 2000) [13]. Cu is necessary for production of melanin pigment and interaction of copper and estrogen are also observed (Hidiroglou, 1979) [14]. Cu deficiency is associated with high molybdenum levels as crops grown on 'tert soils' (having high organic matter) have high Mo and low Cu. Mo and Cu interactions further lowers available Cu for absorption. The important sign related to reproduction in cattle is decline in fertility. Changes in steroidal metabolism may lead to alter reproductive behaviour; such as nymphomania in ewe (Hidiroglou, 1979) [14]. Copper deficiency delayed onset of puberty, repeat breeding, low conception, early embryonic mortality and increased incidence of retention of placenta (Underwood, 1981) [7]. Reproduction is hampered in a manner of depressed oestrus associated with anemia and increased days open due to inactive ovaries. Low fertility associate with delayed or depressed oestrus have been reported in cattle graze on copper deficient pastures (Kreplin and Yaremcio, 1992) [9]. In males, copper deficiency leads to decreased libido, lower semen quality and severe damage of testicular tissue may render the bull sterile (Kreplin and Yaremcio, 1992: Nix, 2002) [9, 15].

Selenium

Severe selenium deficiency results in white muscle disease in lambs and calves, which is characterized by stiffness and heart failure. The activity of selenium is related to vitamin E in that supplementation with either will help prevent white muscle disease. However, since vitamin E levels are normally not a problem, selenium deficiency is usually the underlying problem. Marginal selenium deficiency can result in retained placenta, impaired fertility, silent heat and unthrifty weak calves with poor immune response (resulting in high pre weaning death losses). Selenium can be provided in mineral mixture or in an injectable form. The maximum level of selenium that can be legally fed to cattle is 0.3 ppm in the total ration dry matter. Selenium along with vitamin E function as preventive and chain breaking anti oxidant and inactivates peroxide formed during cell metabolic process (Hine, 1992) [16]. Commonly recorded selenium responsive reproductive disorders of cattle are retained placenta, abortion, still birth, irregular estrous cycle, early embryonic mortality, cystic ovaries, mastitis and metritis which can be reduced by supplementation of selenium (Randhawa and Randhawa, 1994) [17]. In sub clinical selenium deficiency, reproductive performance may be reduced with increased number of services needed per conception, high incidence of mastitis and a retained fetal membrane and this may be explained due to the impaired functioning of neutrophils in selenium deficiency (Goff, 2005) [18]. Selenium beneficial effects of decreasing reproductive problems in dairy animals have been associated with increased glutathione peroxidase activity in blood and tissues. Selenium is readily transmissible through placenta to the foetus whether fed as inorganic or as an organic food Selenium. Improvement in conception rate at first service following selenium supplementation has been reported (McClure *et al*., 1986) [19]. Prepartum injections of Se for 3 weeks decrease the incidence of retained placenta in Se-deficient animals. However, neither vitamin E nor Se was effective alone. Harrison *et al*. (1984) [20] also recorded that the incidence of cystic ovaries and metritis was significantly reduced in Se administered group as compared to untreated controls. The testes contain high concentration of selenium that is essential for testicular function. Low sperm production and poor sperm quality including impaired motility with flagella defects localized primarily to the mid piece has been a consistent feature in selenium deficient animals. Se supplementation in cattle has been found beneficial in maintaining sperm motility.

Manganese

Manganese (Mn) is involved in the activities of several enzyme systems including hydrolases, kinases, decarboxylases and transferases as well as Fe containing enzymes which require Mn for their activity. It is therefore involved in carbohydrate, lipid and protein metabolism. It is also needed for bone growth and maintenance of connective and skeletal tissue. Mn also plays a role in reproduction and in immunological function. In pigs, Mn deficiency results in abnormal skeletal growth, increased fat deposition, reproductive problems and reduced milk production (Boland, 2003) [11]. Manganese levels in forages vary considerably depending on the soils on which they are produced. It is involved as co factor in cholesterol synthesis which is necessary for the synthesis of steroids like progesterone, estrogen and testosterone (Keen and Zidenburg-Cherr, 1990) [21]. Deficiency cause poor fertility problem in both male and female. The principal disorder of Mn deficiency is infertility, congenital limb deformity and poor growth rate in calves. Deficiency of Mn may be associated with suppression of estrus, silent estrus, irregular estrous cycle, cystic ovary, poor follicular developments with delayed ovulation, increase in embryonic mortality and reduced conception rate (Kreplin and Yaremcio,1992: Corrah, 1996) [9, 22]. In males the dietary deficiencies of Mn leads to absences of libido, decreased motility of spermatozoa and reduced number of sperms in ejaculate (Satish Kumar, 2003) [12].

Cobalt

Cobalt is needed for the ruminal synthesis of vitamin B_{12}. Cobalt requirements are higher when cattle are fed high grain diets, because more B_{12} is required to metabolize the end products of rumen fermentation. Cobalt may be very deficient in some soils, so including it in trace mineralized salt is a sound practice. Approximately 4.5% of molecular weight of vitamin B_{12} (cyanocobalamin) is composed of elemental cobalt. The need of cobalt for thymine synthesis, which is required for DNA synthesis, explains the biological role of cobalt for cell division, growth and reproduction. Infertility is likely to arise as a secondary consequence of debilitating condition such as severe cobalt deprivation (Judson *et al.*, 1997) [23]. Sign of cobalt deficiency include delayed uterine involution, irregular estrous cycle and decreased conception rate (Satish Kumar, 2003) [12]. Dietary cobalt requirement for lactating cow is 0.1 ppm of the ration dry matter intake.

Iron

Iron is a part of hemoglobin which transports oxygen to body tissues. Since most forage contains high levels of iron and because substantial amounts of soil are consumed during grazing, iron is almost never deficient in cattle fed forage based diets. A more common problem with iron is that it may be excessively high in forages or in drinking water, which can interfere with the absorption of copper and zinc. It is required for the synthesis of haemoglobin and myoglobin as well as many enzymes and cytochrome enzymes of electron transport chain. Iron functions in transport of oxygen to tissues, maintenance of oxidative enzyme system and is concerned with ferretin formation (Khillare, 2007) [24]. The productive and reproductive performance of iron deficient animals may be badly affected due to anaemia, reduced appetite and lower body condition. A deficient animal becomes repeat breeders and require increased number of inseminations per conception and occasionally may abort.

Iodine

Iodine makes up part of the thyroid hormones. A deficiency results in a condition known as goiter, which is actually an enlarged thyroid gland. Iodine is normally present in the diet as iodide and is necessary for syntheses of thyroid hormone, which regulates energy metabolism. Iodine is important for the development of fetus and maintenance of general basal metabolic rate. The thyroid gland is involved in stimulation of anterior pituitary gonadotrophin secretion. The effect of iodine on secretion of thyrotropin releasing factor, which in turn stimulates prolactin secretion and milk production and effect on length of estrus cycle (Khillare *et al*., 2007) [24].The reproductive disorders due to iodine deficiency are thought to be steroid dysfunction. Iodine deficiency may cause the birth of weak, premature or dead calves affected with goiter. Iodine deficiency in herds, leads to impaired fertility and an abnormally high abortion rate (Hetzel, 1990) [25]. Incidence of retained placenta and post partum genital infections is also high (Hemken, 1960) [26]. Normal plasma inorganic iodine in cows should be 100-300ng/ml.

Chromium

Naturally occurring chromium is crucial for carbohydrate metabolism (Tuormaa, 2000) [13]. It is present in high concentration in nuclear proteins thus it is necessary for gametogenesis and healthy fetal growth. Chromium plays an important role in the secretion of pregnancy specific proteins from the uterine endometrium which is helpful in preventing early embryonic death. Chromium exerts a significant influence on follicular maturation and LH release. It can possibly lead to lower sperm count and decreased fertility and influences foetal growth and development (Tuormaa, 2000) [13].

Molybdenum

Molybdenum is interdependent with Cu with reference to body system of ruminants. Generally lower level of one occurs in presence toxic level of another. Therefore, proper balance of Cu and Mo in soil and plant is essential for normal absorption of each other in ruminants (Randhawa and Randhawa, 1994) [17]. Molybdenum deficiency decreases libido, reduced spermatogenesis and causes sterility in males and is responsible for delayed puberty, reduced conception rate and anoestrus in females (Satish Kumar, 2003) [12].

Conclusions

Keeping in view the important role played by minerals, it is necessary that dairy animals be fed mineral mixture in appropriate quantity and quality, so that energy and protein from the diet of these animals are properly utilized and animals do not suffer from reproductive failures (Gill, 1998) [27]. The composition of an ideal mineral mixture was presented in Table.2

Table 2: Composition of mineral mixture (100Kg)

Sl. no.	Ingredients	Type-I (with salt)	Type-II (without salt)
1	Dicalcium Phosphate(Kg)	55	78
2	Common Salt (Kg)	30	0
3	Chalk Powder (Kg)	11	16
4	Magnesium Carbonate(Kg)	3	4
5	Ferrous sulphate (g)	500	700
6	Copper sulphate (g)	70	100
7	Cobalt chloride (g)	50	70
8	Potassium iodide (g)	10	14
9	Manganese sulphate (g)	70	100
10	Zinc sulphate (g)	250	360

References

1. Poland WW. Mineral concentrations and availability of forages for grazing livestock in the Northern Great Plains Annual Report, Dickinson Research Extension Center, 1089: State Avenue, USA, 2002.
2. Lall D, Dixit VB, Arora U, Kumar B, Chauhan TR. Effect of mineral supplementation on the reproductive performance of ancestors buffaloes under field conditions. Indian Journal of Animal Nutrition. 2000; 17(1):34-39.
3. Davis GV. Mineral and vitamin supplementation of beef cows in Arkansas. UACES Publications. 1999.

4. Hale C, Olson KC. Mineral supplements for beef cattle, University of Missouri, Technical Guide G-2081. 2000.
5. McDowell LR. In: Nutrition of Grazing Ruminants in Warm Climates. Academic Press New York, 1985, 443.
6. Saskatchewan. Trace Minerals for Beef cattle. Saskatchewan's publication. 1992.
7. Underwood EJ. The mineral nutrition of livestock common wealth agriculture bureaus. London, 1981.
8. Prasad CS, Arora SP. Influence of dietary Zn on Beta carotene conversion and on the level of retinol binding protein in the blood serum. Indian journal of Dairy Science. 1979; 32:275-279.
9. Kreplin C, Yaremcio B. Effects of nutrition on beef cow reproduction. Agdex. 1992; 420:51-54.
10. Green LW, Johnson AB, Paterson J, Ansotegui R, Role of trace mineral in cow-calf cycle examined. Feedstuffs News Paper. 1998; 70:34.
11. Boland MP. Trace minerals in production and reproduction in dairy cattle. Advances in Dairy technology, 2003; 15:319-330.
12. Satish Kumar. Management of infertility due to mineral deficiency in dairy animals. In proceedings of ICAR summer school on Advance diagnostic techniques and therapeutic approaches to metabolic and deficiency diseases. 2003.
13. Tuormaa TE. Chromium Selenium Copper and other trace minerals in health and reproduction. Journal of orthomolecular medicine. 2000; 15:145-157.
14. Hidiroglou M. Trace element deficiencies and fertility in ruminants. A Review. Journal of Dairy Science. 1979; 62:1195-1206.
15. Nix J. Trace minerals important for goat reproduction. Sweetlix Livestock Supplement. Document, 2002.
16. Hine RS. (Ed). Oxford Concise Veterinary Dictionary. CBC India. 1992, 875.
17. Randhawa SS, Randhawa CS. Trace element imbalances as a cause of infertility in farm animals. Recent advances in animal reproduction and Gynaecology. Proceedings of the summer institute, held at PAU, Ludhiana on July 25 to Aug 13. 1994, 103-121.
18. Goff JP. Major advances in our understanding of nutritional influnces on bovine health. Journal of Dairy Science. 2005; 89:1272-1301.
19. McClure TJ, Eamen GJ, Healy PJ. Improved fertility in dairy cows after treatment with selenium pellets. Australian Veterinary Journal. 1986; 63:144-146.
20. Harrison J, Hancock DD, Conrad HR. Vitamin E and selenium for reproduction of the dairy cow. Journal of Dairy Science. 1984; 67:123.
21. Keen CL, Zidenberg-Cheer S. Manganese. In: present knowledge in nutrition. (M.L. Brown Ed.) International Life science Institute Nutrition Foundation, Washington, D.C. 1990, 279-288.
22. Corrah L. Trace mineral requirements of grazing cattle. Animal Feed Science and Technology. 1996; 59:61-70.
23. Judson GJ, Mcfarlane JD, Mitsioulis A, Zviedrans P. Vitamin B 12 responses to cobalt pellets in beef cows. Australian Veterinary Journal. 1997; 75:660-662.
24. Khillare KP, Trace Minerals and Reproduction in Animals. Intas Polivet. 2007; 8(2):308-314.
25. Hetzel BS. Iodine deficiency: an international public health problem. in: Present Knowledge in Nutrition. (Brown, M.L., Ed.) 6th Ed. International Life science Institute Nutrition Foundation, Washington D C. 1990, 308-313.
26. Hemken RW. Iodine. Journal of Dairy Science. 1960; 53:1138-1143.
27. Gill RS. Feeding strategies for various parts of India in view of available feed resources. Indian dairy man. 1998; 90:76-80.