

# BEEF CATTLE MINERAL SUPPLEMENTATION ON *Arizona Rangelands*

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## Clinical and Subclinical Symptoms of Mineral Deficiencies

Have you ever seen cows eating bones (pica), having retained placentas, or exhibiting abnormal hair coloration? These may be symptoms of mineral deficiencies. Livestock exhibiting pica are suspect for phosphorus deficiency; cows that retain placentas may have a selenium deficiency (though difficult births can also show this symptom); and dark cattle may have abnormal hair coloration (e.g. red or gray tinge for Angus) due to a copper deficiency. However, oftentimes clinical signs of mineral deficiencies are not exhibited, rather subclinical signs that you can not observe exist such as reduced immunity, impaired fertility, or reduced growth.

Arizona calves are sometimes discounted

minerals of concern on Arizona rangelands are copper, selenium, and zinc. If your ranch consists of granitic or volcanic derived soils, then you most likely have a selenium deficiency in your forage. The minimum selenium required in forage is 0.1 ppm, but most of the forage samples we have tested on these types of soils have been 30 to 50% of the minimum required. It has long been known that copper is deficient on sandy soils.

Additionally, granitic and volcanic derived soils in Arizona can be deficient in copper during some years. Zinc has been found to be deficient in Arizona forages for most rangelands according to amounts specified by the National Research Council Nutrient Requirements for Beef Cattle. However, some of the research we have done has

We have found that in wetter years, copper availability in the forage may actually decline (Figure 4, page 26). Conversely, wetter years appear to have the opposite effect with selenium (Figure 5, page 26).

Another trace mineral of concern is iron, but not for being deficient. Most sampling we have done indicates that iron is sufficiently high in forage (Figure 6, page 26) so that additional iron should not be added to the mineral supplement beyond that amount which is unavoidable due to mixing of other mineral compounds. Unfortunately, many mineral mixes have iron oxide added to give the mineral mix a reddish brown color. We strongly encourage using an actual mineral mix that is matched to Arizona conditions (as assessed by forage testing) and not a generic "mineral block"

Figure 1. Copper Content by Forage Group  
X4 Ranch in Globe

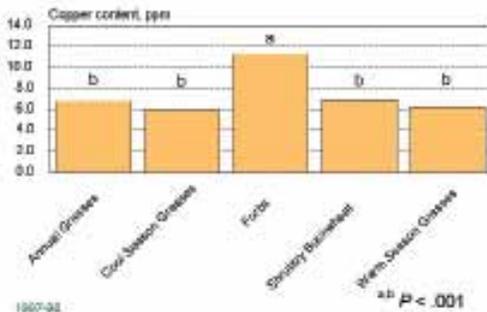


Figure 2. Zinc Content by Forage Group  
X4 Ranch in Globe

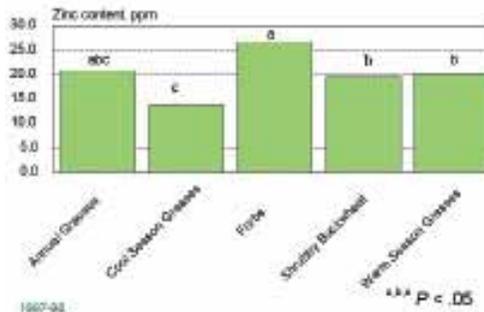
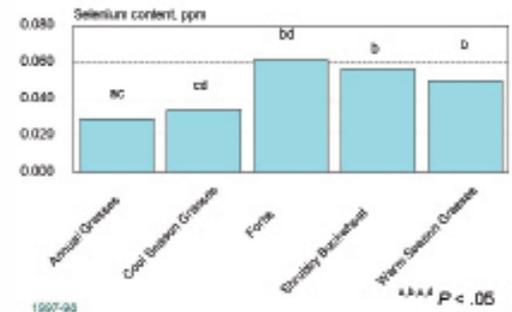


Figure 3. Selenium Content by Forage Group  
X4 Ranch in Globe



in the marketplace because of increased morbidity in the feedlot. In fact, a term commonly used is "naïve Arizona cattle". A variety of factors can contribute to increased sickness for Arizona calves in the feedlot including the extensive nature of Arizona rangelands that limits exposure to pathogens, limited vaccination programs, and a lack of mineral supplementation needed to maintain immune function.

## What Minerals are Deficient in AZ Forage?

The University of Arizona has been involved in mineral research for several years and we have assembled a body of evidence to describe common mineral deficiencies. The macro-mineral of major concern for Arizona rangelands is phosphorus which may be deficient from eight to ten months of the year. The trace

indicated that there is a need for more research on zinc requirements for range cattle. Table 1 (see page 27) lists the nutrient requirements for trace minerals in beef cattle. Phosphorus requirements vary with milk production and stage of gestation, but a 1,100 lb. cow with 15 lbs./day of milk at peak lactation would require 21 grams/day in early lactation, 17 g/d in late lactation, 12 g/d in mid gestation, and 16 g/d pre-calving (spreadsheet calculator available from this office). We have found that P in the mineral mix needs to be held to no more than 6 to 8%, or intake of the mineral supplement may decline sharply.

The concentration of copper, selenium, and zinc varies by the type of forage (see Figures 1, 2 and 3) as well as year. Our research corroborates that of Oregon State University with respect to copper.

which may be deficient for most trace minerals of concern as well as having an antagonistic effect with added iron.

## What Mineral Mix should I Use?

Table 2 (see page 27) lists our mineral concentration recommendations for a loose mineral mix to fit most of Arizona. If you use a block mineral supplement, you will need to increase the concentrations shown since intake will be less (usual block intakes are about 1.0 to 1.5 oz./day). However, if you ranch in the Arizona Strip north of the Grand Canyon we encourage you to obtain forage samples to establish the mineral concentrations in your forage. The values shown for the figures in this article are from the X4 Ranch near Globe and from the University of Arizona V-V Ranch between Camp Verde and Happy Jack. If you desire to test your

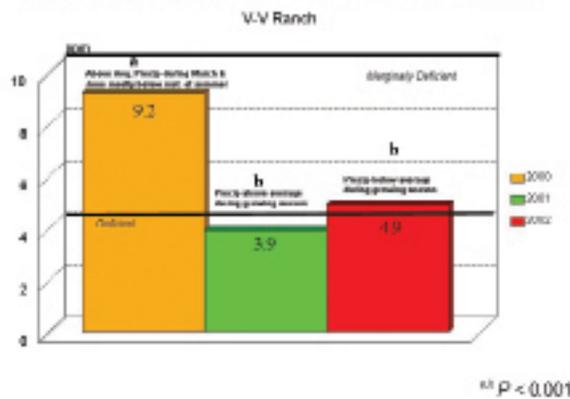
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forage for mineral concentration, we recommend that you carefully choose sites that represent larger land forms on the ranch. We suggest you sample separately those areas with widely divergent soils and different vegetation types in dominant grazing pastures for the ranch. A good way to break out the sampling would be by geology. You can expect to obtain different results for limestone derived soils when compared to volcanic and granitic soils.

At a minimum, we suggest you have the commercial lab you use test the samples for selenium, zinc, copper, sulfur, phosphorus, and molybdenum. You could consider pooling samples by species among the different pastures you sample as long as the geology is not different. We suggest you pick at least two or three key species of grasses which your cattle prefer and graze for a large portion of their diet and perhaps one shrub such as shrubby buckwheat. Clip the grasses to approximately ground level and clip this year's leaders on shrubby buckwheat. Put a good sized handful of each sample in a paper lunch bag and label with ranch name, date, forage species, and pasture(s). For my last samples a couple of years ago, selenium testing cost approximately \$44 each for drying, grinding, and testing for selenium. This mineral is difficult to analyze and you should use a lab that is very familiar with these analyses. To save money, you could then have that lab ship the samples to another lab to have them analyzed by ICP for Ca, P, Mg, K, Na, Fe, Zn, Cu, Mn, Mo, Co, and S. In the past, it cost me approximately \$26 per sample at the other lab but you should call them to get the price for ICP mineral analyses with dried and ground samples. The ICP analysis is a basic package deal and will not cost extra for the additional minerals. If you are interested in further information concerning commercial labs that can perform this service, please contact this office for more information.

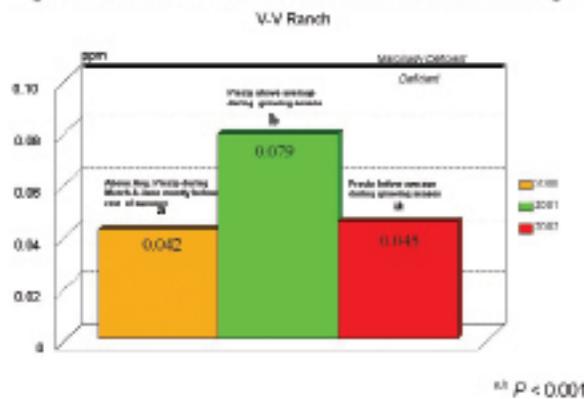
You can get by with less sampling, particularly if the samples are obtained during forage dormancy and in a dry year. This should obtain trace mineral values in forage when it is as bad as it gets and which is what you want to supplement for. This will work for most of the minerals except copper which we have found to be decreased in wetter years. In an ideal situation with no financial constraints, I would collect samples during the winter

Figure 4. Copper Concentrations in Forage



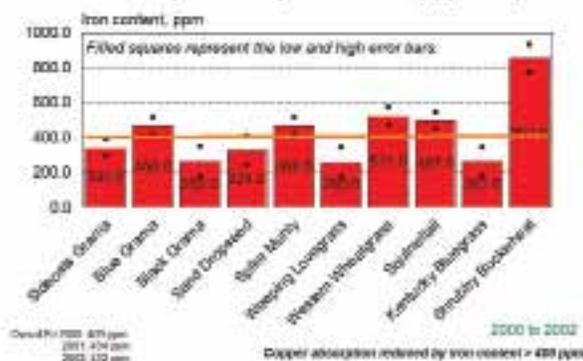
We have found that in wetter years, copper availability in the forage may actually decline (Figure 4).

Figure 5. Selenium Concentrations in Forage



Conversely, wetter years appear to have the opposite effect with selenium (Figure 5).

Figure 6. Iron Content of Major Forage Species V-V Ranch (near Camp Verde to Happy Jack)



Most sampling we have done indicates that iron is sufficiently high in forage (Figure 6) so that additional iron should not be added to the mineral supplement beyond that amount which is unavoidable due to mixing of other mineral compounds.

dormancy period, during spring green-up, during the summer slump, and during the monsoon season to collect baseline data. However, if you collect when the forage is green and when it is dry that may suffice. Another reason for obtaining two samples would be to see what phosphorus content is when the forage is green.

If you decide to have your forage tested for mineral content, the next step after receiving the results would be to supply what is missing in the forage with a commercially mixed mineral supplement. This office can assist you in this determination and we have a spreadsheet available to assist you with your custom mix. You will also want to consult with the feed company's nutritionist. Most commercial feed companies will formulate your mineral mix for you if they don't already have one in stock to fit your requirements. This will usually require a minimum batch order. Several years ago, that amount was 4 tons, but you will need to check with them about the batch requirement and cost estimate.

### How Much Mineral Will My Cows Eat?

Good question. Over a long term average, mineral intake for the herd may average 3 oz/day for a loose mineral mix. However, there is considerable variation in individual intake. We designed and conducted a series of trials with a high precision solar powered data acquisition system for obtaining individual mineral intakes by livestock in a rangeland setting (Figure 7). The equipment had  $\pm 2$  g resolution in pre-dawn hours when ambient conditions were constant and  $\pm 17$  g resolution when metal equipment was expanding during mid-morning, mid-day, and mid-afternoon. Cattle were individually identified with a wildlife camera and weights of mineral removed were obtained every 0.25 seconds. Over the course of the trial, cattle which accessed the mineral feeder consumed an average of 1.3 oz/day in 2010 and 2.8 oz/day in 2011. However, cattle did not visit the feeder every day. The average intake for the day when cattle came to the feeder in 2010 was 6.7 oz/day and it varied from 0 to 35.6 oz/day consumed. In 2011, the average consumption for the day was 23.4 oz/day with intake varying from 0 to 76.7 oz/day. Less dominant animals in the herd may access the mineral feeder during evening hours when less competition occurs. All of this points to the need to keep a constant supply of mineral supplement available. When

