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Mineral Concentrations in Grazed Cool-Season Annual Grass Pastures in North Florida[1]

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Minerals make up a small portion of an animal's diet; however, they play an important role in health, growth and reproduction.

While free-choice mineral supplementation is common for beef cattle on pasture, pasture forage is still the main source of many nutritionally essential minerals. In the southeastern USA when permanent warm-season pastures are dormant, cool-season annual grasses, such as oats, rye and annual ryegrass, are commonly planted to provide forage for grazing by beef cattle during the late fall to spring period. These forages are highly digestible and are high in energy and protein; however, there is limited information about concentrations of various nutritionally important minerals.

North Florida Grazing Study

A four-year grazing study was conducted at the North Florida Research and Education Center (NFREC) Beef Unit which is located near Marianna in northwest Florida. The study evaluated two cool-season pasture establishment methods (sod-seeding into dormant warm-season pasture or planting into a clean tilled prepared seed-bed) and two forage treatments (mono-crop vs. a mixture of forage species) for grazing by growing beef cattle. A mineral study was a component of this grazing study. The purpose of the mineral study was to measure monthly concentrations of selected minerals in forage from the various pastures used in the grazing study during the late fall-winter-spring grazing season in north Florida. The minerals measured were the macro minerals calcium (Ca) phosphorus (P), sodium (Na), potassium (K) and magnesium (Mg), and the trace minerals copper (Cu), iron (Fe), zinc (Zn), manganese (Mn), cobalt (Co) and selenium (Se).

The pasture soils were well-drained acidic, sandy soils (fine loamy, kaolintic, thermic Kandiudults) typical of the Southern Coastal Plain. Prior to planting each year, pastures were fertilized and, if needed, dolomite lime applied based on soil analyses by a commercial laboratory. All pastures over the 4 yr period were grown under dry land conditions. The pastures were top dressed twice, with 75 lb N/ac., within each year.

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Mineral Concentrations

The overall average concentrations obtained of the minerals measured from the four-year study are presented in the Tables 1 and 2. Very little effect due to annual cool-season pasture forage treatment or pasture establishment method was noted on concentrations of the minerals evaluated. Some year-to-year variation was noted for all minerals except sodium. Magnesium varied the most, almost two-fold from year-to-year.

Month of grazing season, however, had greatest influence on concentrations of minerals evaluated (see Figures 1, 1a and 2). There was a large month-to-month variation in concentrations of potassium, phosphorus, iron and manganese, little variation for calcium, magnesium, copper and cobalt, and essentially no variation for sodium and selenium. Forage concentrations of phosphorus and potassium were greatest during the winter and declined during spring with lowest levels noted in May; magnesium was lowest in early spring. Concentrations of iron decreased and manganese increased as the grazing season progressed. Due to high costs, only few samples were analyzed for cobalt and selenium and thus limited monthly data. Nonetheless, there was evidence that cobalt increased as the grazing season progressed (from 0.05 ppm early on to 0.10 ppm in May); selenium did not vary much from month to month (0.05 to 0.06 ppm). Please note that some important essential minerals such as iodine and chlorine were not measured. Iodine (iodized salt) and chlorine (ordinary salt) are present in typical cattle mineral supplements.

Overall average concentrations of calcium and magnesium from our study were at the low end of ranges of concentrations previously published for ryegrass, rye and oat forage grown in other parts of the USA; phosphorus and potassium were at the high end and sodium in the middle (Table 1). Concentrations of iron and manganese were lower than previously reported, zinc higher, and copper and selenium were similar (Table 2). However, large variations in concentrations were noted in our study as mention above.

Implications of Findings

From our findings and compared to requirements, sodium would be very deficient, copper, selenium and cobalt would be deficient, calcium would be slightly deficient, phosphorus, magnesium and zinc would be marginally deficient, iron and manganese would be adequate, and potassium would be in excess for beef cattle grazing cool-season pastures in the southeastern USA (Tables 1 and 2). Fortunately, most free-choice cattle mineral supplements will more than make up for these deficiencies **provided that mineral supplement is present and that the cattle are consuming it**.

The marginally low forage magnesium concentrations noted in this study, combined with the high potassium concentrations, may be a potential magnesium deficiency problem for beef cattle which can result in grass tetany (hypomagnesemia), especially during the early spring months. This reinforces that specially formulated high magnesium (hi-mag) mineral supplement should be offered at this time. Further information about grass tetany and its prevention can be found in the UF/IFAS Extension publication entitled “Grass Tetany in Cattle” (SS AGR-64/DS 137) which can be found on the EDIS website (edis.ifas.ufl.edu).

Table 1. Macro-mineral concentrations of grazed cool-season annual grasses in north Florida (dry weight basis).

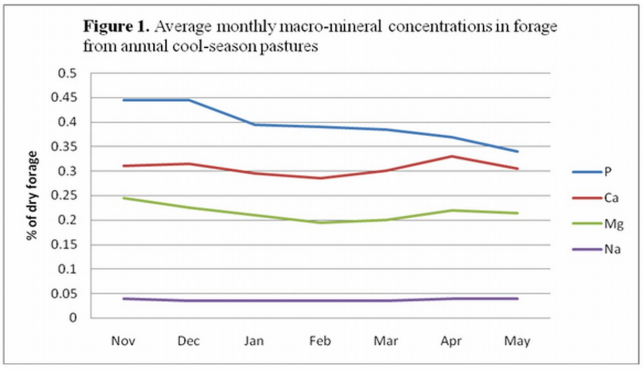
Mineral	Concentration, %	Requirement[a], %	Reported[b], %
Calcium	0.31 ± 0.05	0.3 to 0.5	0.32 to 0.65
Phosphorus	0.38 ± 0.04	0.2 to 0.4	0.23 to 0.41
Sodium	0.04 ± 0.01	0.1	0.01 to 0.11
Potassium	2.9 ± 0.3	0.6	1.7 to 3.4
Magnesium	0.21 ± 0.3	0.1 to 0.2	0.20 to 0.35

[a]Taken from Nutrient Requirements of Beef Cattle, National Research Council (2000). [b]Previously reported concentrations in fresh ryegrass, oat and rye forage (dry weight basis; from Ensminger et al., 1990, *Feeds and Nutrition*, Ensminger Publishing Co., Clovis, CA, USA and NRC, 2000.

Table 2. Trace mineral concentrations of grazed cool-season annual grasses in north Florida (dry weight basis).

Mineral	Concentration, ppm	Requirement[a], ppm	Reported[b], ppm
Copper	5.8 ± 0.8	10	4 to 8
Iron	83 ± 14	50	101 to 367
Zinc	40 ± 5	30	25 to 30
Manganese	110 ± 14	40	42 to 66
Cobalt	0.06 ± 0.01	0.1	--
Selenium	0.05 ± 0.01	0.1	0.07

[a]Taken from Nutrient Requirements of Beef Cattle, National Research Council (2000). [b]Previously reported concentrations in fresh ryegrass, oat and rye forage (dry weight basis; from Ensminger et al., 1990, *Feeds and Nutrition*, Ensminger Publishing Co., Clovis, CA, USA and NRC, 2000.



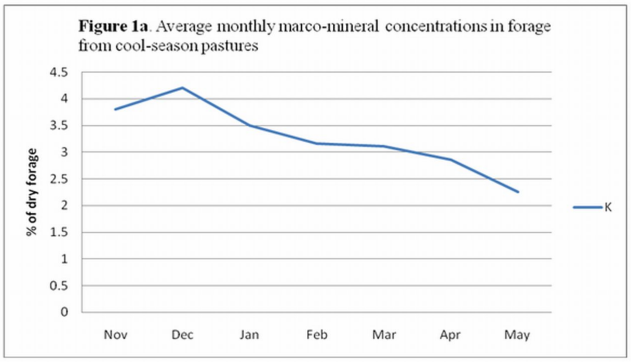


Fig1. Average monthly macro-mineral concentrations in forage from annual cool-season pastures.

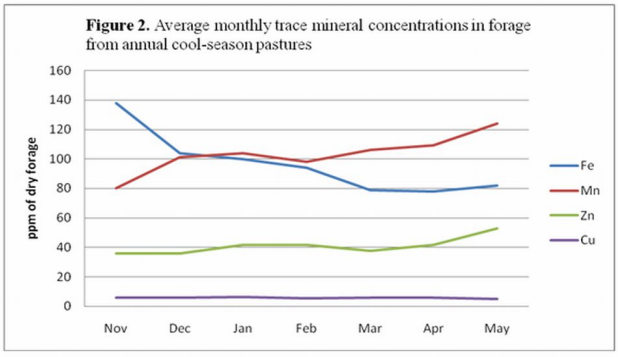


Fig.2. Average monthly trace mineral concentrations in forage from annual cool-season pastures.