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## Mineral Contents of Native Bluestem Pastures

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### Summary

Handclipped and esophageal samples of burned and control native bluestem pastures were taken monthly. Burning increased phosphorus (P) and magnesium (Mg) and decreased iron (Fe). These studies indicate that burned and unburned pastures need to be supplemented with potassium (K), magnesium (Mg), and possibly phosphorus (P) during late fall and winter. A supply of sodium (Na) is necessary continuously.

### Introduction

Previous work here indicated that Na supplement (salt) was necessary on bluestem pastures but Ca and P supplements (bone meal, dicalcium phosphate, etc.) did not improve cow-calf operations. Trace mineral supplements have not affected performance.

A comprehensive evaluation of the mineral content of bluestem pastures has not been attempted previously because laborious techniques gave inconsistent results. With the station's atomic absorption spectrophotometer, we now can analyze a variety of elements with great accuracy.

### Methods

Burned and control pastures were sampled monthly by handclipping or from esophageally-fistulated steers. Samples were analyzed for calcium, phosphorus, magnesium, potassium, sodium, iron, manganese, zinc, and copper. Results are reported in the tables on a dry basis.

### Results and Discussion

Mineral compositions are shown in two tables according to sampling method. Table 9.1 is for handclipped samples. That procedure assumes that animals graze all plants to 1 inch above ground level, which obviously is not accurate. Table 9.2 is for data that resulted from analyzing plants the animals actually consumed. Salivary contamination causes errors in that procedure. Large increases of sodium and phosphorus are found in esophageal samples. Magnesium, on the other hand, was leached out, possibly in salivary juices lost during collection.

Macroelements are given in percentages and microelements (trace minerals) in milligrams per 100 grams of dry material.

Calcium: The Ca content of these pastures was highest during winter months, lowest in September. But September values were above the

recommended values for growing steers (0.30-0.44%) and for gestating and lactating cows (0.16-0.24%). No Ca supplement is needed.

Phosphorus: The P content was higher in burned than unburned pastures and higher in winter and spring than in summer or fall. Handclipped samples were lower than recommended levels (0.18-0.22%) every month of the year. The esophageal samples show that salivary contamination produces a bolus above recommended levels. So the body pool of P is enough to maintain adequate P. Previous studies here showed that even though blood P may be below normal at certain times of the year, supplementing pastures with phosphorus made no differences in performance (cow weight, calf birth, or weaning weight).

Ca/P ratio: The Ca/P ratio is recognized as important in animal nutrition and a suitable ratio is within 2.0 to 0.5. The ratio obtained in this study varied from about 6.0 to 1 to 6.6 to 1, much wider than the 2.0 to 0.5. The only time the Ca/P ratio narrowed to 4 to 1 was in May. While 6.0 to 1 may be considered wide, the NRC has reported 7 to 1 as satisfactory.

Magnesium: Burning increased Mg content, and Mg trended higher from winter to spring and fall, with a minor reduction in summer. Our data indicate that Mg in bluestem pastures meets the requirement of 0.06 to 0.15%.

Sodium: The Na content in handclipped samples did not meet the NRC requirement of 0.25% but esophageal samples averaged 1.6%, more than adequate. Animals samples had access to salt blocks during the year. Salt should be kept available because Na turns over rapidly in the body pool.

Potassium: Burning did not significantly affect K; however, its monthly variation in bluestem pastures may be significant. It was below recommended levels of 0.6 to 0.8%. No minimum recommendation is given by NRC but 1 lb. of soybean meal plus 3 to 6 lbs. of milo in winter will not supply 0.6% of K. That finding prompted us to measure the response of cattle to K in a test now in progress (1978 winter).

Iron: Burning reduced the iron content of the pastures, which was highest in early spring and had declined by July. Most cattle feeds range from 8 to 80 mg. Fe/100 g., which is thought to be adequate. The lowest iron value we recorded was 13.9 mg. in handclipped samples and 16.3 in esophageal samples.

Copper: Copper tended to rise from March to a peak in May and then decline. Values indicate that the pastures contain adequate copper during most of the grazing season. Copper from esophageal samples suggest copper in the body pool may overcome low levels in winter. Supplementing copper is questionable, but we need a performance trial before making recommendations.

Manganese: All of Mn values were above the 0.1-1.0 mg./100 g. recommended by the NRC.

Zinc: All Zn values were above the NRC requirement of 1.0-3.0 mg./100 g. for cattle.

### Conclusion

Findings in this experiment indicate that supplementing with salt (NaCl) the year round is advisable. Other minerals that may be deficient and need further study include potassium (K) and copper (Cu).

Table 9.1. Mineral contents of forage samples handclipped from Flint Hills pastures.

| 1. Burned pasture     |            |      |      |      |       |            |      |      |      |
|-----------------------|------------|------|------|------|-------|------------|------|------|------|
| Months                | Ca         | P    | Mg   | Na   | K     | Fe         | Cu   | Mn   | Zn   |
|                       | Percentage |      |      |      |       | mg./100 g. |      |      |      |
| 1975 Oct.             | .542       | .094 | .178 | .009 | .715  | 23.1       | .237 | 3.33 | 2.90 |
| Nov.                  | .542       | .082 | .121 | .017 | .194  | 24.1       | .277 | 3.04 | 3.46 |
| Dec.                  | .575       | .106 | .077 | .006 | .113  | 28.0       | .371 | 3.79 | 3.35 |
| 1976 Jan.             | .489       | .063 | .081 | .006 | .087  | 28.7       | .230 | 3.61 | 3.16 |
| Feb.                  | .517       | .061 | .079 | .007 | .095  | 31.8       | .442 | 3.04 | 3.09 |
| Mar.                  | .504       | .059 | .069 | .007 | .116  | 47.1       | .646 | 4.61 | 3.38 |
| Apr.                  | .451       | .056 | .056 | .012 | .165  | 42.9       | .499 | 3.75 | 3.75 |
| May                   | .546       | .117 | .146 | .018 | 1.790 | 47.1       | .991 | 5.65 | 3.93 |
| Jun.                  | .385       | .069 | .168 | .008 | 1.230 | 18.4       | .709 | 7.23 | 2.67 |
| Jul.                  | .517       | .060 | .138 | .008 | 1.100 | 13.9       | .621 | 3.28 | 2.78 |
| Aug.                  | .516       | .060 | .157 | .007 | .870  | 22.9       | .614 | 5.03 | 3.49 |
| Sept.                 | .342       | .062 | .171 | .005 | .737  | 14.2       | .363 | 8.12 | 1.88 |
| Mean                  | .494       | .074 | .120 | .009 | .601  | 28.5       | .500 | 4.54 | 3.15 |
| 2. Pasture not burned |            |      |      |      |       |            |      |      |      |
| 1975 Oct.             | .731       | .171 | .128 | .057 | .739  | 22.1       | .494 | 3.83 | 3.89 |
| Nov.                  | .661       | .074 | .077 | .006 | .133  | 21.9       | .245 | 3.10 | 2.92 |
| Dec.                  | .819       | .096 | .108 | .007 | .153  | 61.6       | .346 | 5.05 | 4.29 |
| 1976 Jan.             | .697       | .097 | .088 | .007 | .174  | 38.6       | .262 | 3.34 | 3.69 |
| Feb.                  | .424       | .075 | .057 | .014 | .089  | 28.0       | .292 | 4.67 | 2.59 |
| Mar.                  | .467       | .058 | .053 | .007 | .079  | 40.7       | .331 | 4.96 | 3.39 |
| Apr.                  | .527       | .058 | .052 | .007 | .312  | 61.0       | .367 | 4.94 | 4.68 |
| May                   | .582       | .121 | .130 | .011 | 1.540 | 61.6       | .991 | 5.12 | 4.57 |
| Jun.                  | .429       | .092 | .111 | .006 | 1.420 | 10.9       | .622 | 2.15 | 2.61 |
| Jul.                  | .491       | .084 | .130 | .009 | 1.090 | 14.4       | .653 | 2.85 | 2.31 |
| Aug.                  | .482       | .073 | .113 | .006 | .931  | 14.7       | .727 | 4.11 | 2.56 |
| Sept.                 | .342       | .092 | .117 | .006 | .639  | 17.0       | .408 | 4.66 | 2.08 |
| Mean                  | .554       | .091 | .097 | .012 | .608  | 32.71      | .478 | 4.07 | 3.30 |

Table 9.2. Mineral contents of forage samples collected from fistulated steers on Flint Hills pastures.

| 1. Burned pasture     |            |      |      |      |       |            |       |      |      |
|-----------------------|------------|------|------|------|-------|------------|-------|------|------|
| Months                | Ca         | P    | Mg   | Na   | K     | Fe         | Cu    | Mn   | Zn   |
|                       | Percentage |      |      |      |       | mg./100 g. |       |      |      |
| 1975 Oct.             | 1.143      | .300 | .110 | 1.47 | .645  | 43.2       | .278  | 4.47 | 5.73 |
| Nov.                  | .542       | .270 | .047 | 1.65 | .395  | 28.4       | .493  | 3.39 | 3.22 |
| Dec.                  | .537       | .241 | .046 | 1.95 | .271  | 21.8       | .298  | 2.77 | 3.04 |
| 1976 Jan.             | .570       | .264 | .056 | 1.60 | .277  | 32.9       | .235  | 2.95 | 5.31 |
| Feb.                  | .548       | .262 | .049 | 1.52 | .322  | 46.5       | .175  | 3.71 | 4.02 |
| Mar.                  | .487       | .213 | .051 | 1.62 | .283  | 45.4       | .253  | 3.34 | 3.29 |
| Apr.                  | .560       | .278 | .088 | 1.50 | 1.025 | 71.0       | .401  | 6.26 | 5.19 |
| May                   | .630       | .351 | .109 | 1.54 | 1.700 | 89.8       | .649  | 6.87 | 5.78 |
| Jun.                  | .694       | .208 | .155 | 1.45 | 1.120 | 30.4       | .687  | 7.77 | 3.27 |
| Jul.                  | .464       | .201 | .106 | 1.92 | 1.264 | 26.7       | .526  | 4.08 | 2.89 |
| Aug.                  | .636       | .168 | .118 | 1.55 | .594  | 21.3       | .621  | 5.14 | 2.37 |
| Sept.                 | .899       | .194 | .122 | 1.62 | .776  | 27.1       | .666  | 7.89 | 2.93 |
| Mean                  | .643       | .246 | .088 | 1.62 | .722  | 41.2       | .440  | 4.89 | 3.92 |
| 2. Pasture not burned |            |      |      |      |       |            |       |      |      |
| 1975 Oct.             | 1.865      | .420 | .148 | 1.57 | .760  | 22.5       | .526  | 5.44 | 6.72 |
| Nov.                  | .644       | .285 | .058 | 1.51 | .496  | 28.2       | .318  | 3.68 | 4.18 |
| Dec.                  | .567       | .219 | .051 | 1.44 | .313  | 29.7       | .622  | 3.82 | 4.06 |
| 1976 Jan.             | .538       | .223 | .046 | 1.72 | .502  | 20.8       | .225  | 2.99 | 3.99 |
| Feb.                  | .621       | .248 | .046 | 1.58 | .301  | 36.6       | .400  | 4.09 | 3.83 |
| Mar.                  | .485       | .216 | .053 | 1.58 | .351  | 65.0       | .331  | 4.87 | 4.35 |
| Apr.                  | .670       | .271 | .077 | 1.86 | 1.088 | 74.2       | .644  | 5.41 | 7.36 |
| May                   | .655       | .377 | .099 | 1.42 | 1.560 | 68.6       | .614  | 6.92 | 5.28 |
| Jun.                  | .998       | .261 | .113 | 1.55 | 1.274 | 56.0       | 1.001 | 3.32 | 4.01 |
| Jul.                  | .631       | .221 | .074 | 1.37 | .624  | 16.3       | .357  | 3.31 | 2.44 |
| Aug.                  | .761       | .204 | .099 | 1.64 | .668  | 26.5       | .478  | 4.41 | 3.09 |
| Sept.                 | 1.743      | .238 | .222 | 1.67 | .908  | 33.8       | .862  | 6.46 | 3.59 |
| Mean                  | .848       | .265 | .091 | 1.58 | .737  | 39.0       | .532  | 4.56 | 4.41 |