

Mineral Content of Feeds Grown at
Various Kansas Locations (Project 430)

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Earlier experiments have shown that cattle may perform differently at different Kansas locations. Feeds from four locations (Manhattan, Mound Valley, Colby, and Garden City) were analyzed for several minerals to see if mineral differences might be responsible.

Table 4 shows the results for alfalfa hay. Samples were taken at random and no attempt was made to choose particular varieties.

Data for FS 1_a sorghum silage is shown in table 5.

Table 6 shows mineral analyses for two sorghum grain varieties, and one mixed sample (varieties unknown) taken at each location. The K.S.U. agronomy department carries out annual tests on eleven varieties of forage sorghum at four locations (Garden City, Manhattan, Mound Valley, and Colby). The results are in table 7.

Using the tables

Such information should help in formulating rations, because the mineral values are established under Kansas conditions. Crops and feeds vary greatly in water content, so all water was removed before analyses. To apply the data to specific feeds, dry matter content of the feeds is needed. Grains stored in bins are usually about 87% dry matter. High moisture grains are about 70% dry matter. Silages are about 35% dry matter, but vary widely. Multiply the percentage of dry matter by the appropriate mineral level from the table. For example, the phosphorus content of Pioneer 846 sorghum grain at Colby is 0.28%. Assume a similar grain were stored under high moisture conditions (70% dry matter). The level of phosphorus in the grain, as taken from storage, would be $70\% \times 0.28 = 0.20\%$.

Table 8 shows the estimated mineral requirements for feedlot cattle. From those figures and the feed analysis data, ration adequacy can be estimated.

All biological measurements are subject to variability. Table 7 gives averages \pm "standard deviation" to account for such variability. The standard deviation is a mathematical way of expressing how much you expect the data to vary. The average, plus or minus the standard deviation, should include two-thirds of the observations. The average plus or minus two standard deviations should include 95%.

Conclusions

The feed analyses show the variability of feed minerals. Some of the variation results from location. However, feed samples taken at the same, or similar locations also vary, which shows the dangers associated with accepting "book values". Book values are averages, often of data that vary widely.

Three minerals, calcium, phosphorus, and sodium chloride (salt), are routinely added to cattle rations. Comparing requirements with the analyses of Kansas feeds shows why. Sodium is almost absent from most feeds. Most combinations of feeds meet requirements for magnesium. Manganese and iron are likely to be deficient on high sorghum-grain diets. Zinc and copper are likely to be borderline or deficient in most diets.

Table 4. Mineral Analysis of Kansas-grown Alfalfa Hay ¹

| Location | | % | % | % | % | % | ppm ² | ppm | ppm | ppm |
|-----------------------|------|---------|------------|-----------|-----------|--------|------------------|------|------|--------|
| | | Calcium | Phosphorus | Magnesium | Potassium | Sodium | Manganese | Iron | Zinc | Copper |
| Colby(2) ³ | High | 1.55 | 0.25 | 0.23 | 3.16 | 0.164 | 46.8 | 432 | 19.9 | 11.0 |
| | Low | 1.02 | 0.25 | 0.20 | 3.10 | 0.144 | 45.2 | 256 | 18.7 | 8.3 |
| | Ave. | 1.29 | 0.25 | 0.22 | 3.13 | 0.154 | 46.0 | 346 | 19.3 | 9.6 |
| Garden City(3) | High | 1.80 | 0.31 | 0.35 | 3.04 | 0.075 | 44.4 | 685 | 21.0 | 15.2 |
| | Low | 1.33 | 0.17 | 0.27 | 1.84 | 0.021 | 35.0 | 166 | 18.3 | 9.9 |
| | Ave. | 1.64 | 0.25 | 0.30 | 2.25 | 0.040 | 40.7 | 346 | 19.9 | 12.3 |
| Manhattan (3) | High | 1.73 | 0.34 | 0.33 | 1.93 | 0.042 | 47.6 | 474 | 25.6 | 14.3 |
| | Low | 1.53 | 0.18 | 0.21 | 1.23 | 0.018 | 39.9 | 124 | 22.3 | 11.8 |
| | Ave. | 1.63 | 0.26 | 0.28 | 1.67 | 0.031 | 42.8 | 275 | 23.9 | 12.8 |
| Mound Valley(4) | High | 1.62 | 0.39 | 0.42 | 2.06 | 0.173 | 47.5 | 408 | 48.1 | 12.5 |
| | LOW | 1.33 | 0.26 | 0.27 | 1.65 | 0.081 | 38.7 | 138 | 35.8 | 10.4 |
| | Ave. | 1.46 | 0.32 | 0.35 | 1.87 | 0.133 | 42.4 | 247 | 42.0 | 11.7 |

1. Dry matter basis
2. Parts per million 1 ppm = 0.0001%
3. Number of samples per location

Table 5. Mineral Analysis of Kansas-grown Sorghum Silage¹
(Variety, FS 1a)

| Location | % | % | % | % | % | ppm ² | ppm | ppm | ppm |
|--------------|---------|------------|-----------|-----------|--------|------------------|------|------|--------|
| | Calcium | Phosphorus | Magnesium | Potassium | Sodium | Manganese | Iron | Zinc | Copper |
| Colby | 0.21 | 0.18 | 0.18 | 1.29 | 0.013 | 47.5 | 487 | 27.9 | 13.1 |
| Garden City | 0.36 | 0.19 | 0.25 | 1.46 | 0.012 | 75.2 | 724 | 19.8 | 19.2 |
| Manhattan | 0.25 | 0.15 | 0.15 | 1.54 | 0.010 | 43.6 | 159 | 24.0 | 13.1 |
| Mound Valley | 0.43 | 0.23 | 0.34 | 1.24 | 0.016 | 58.2 | 210 | 46.8 | 7.3 |

1. Dry matter basis

2. Parts per million. 1 ppm = 0.0001%

Table 6. Mineral Analysis of Kansas-grown Sorghum Grains¹

| Location | % Calcium | % Phosphorus | % Magnesium | % Potassium | % Sodium | ppm ² Manganese | ppm Iron | ppm Zinc | ppm Copper |
|--------------------------------|--------------|-----------------|----------------|----------------|-------------|-------------------------------|-------------|-------------|---------------|
| --- RS - 610 ³ ---- | | | | | | | | | |
| Colby | 0.014 | 0.42 | 0.19 | 0.49 | 0.006 | 19.0 | 60.6 | 19.6 | 6.6 |
| Garden City | 0.018 | 0.37 | 0.20 | 0.50 | --- | 19.2 | 62.9 | 28.7 | 10.9 |
| Manhattan | 0.029 | 0.55 | 0.25 | 0.62 | 0.005 | 18.9 | 72.1 | 35.6 | 6.7 |
| Mound Valley | 0.026 | 0.49 | 0.23 | 0.58 | 0.007 | 18.3 | 77.0 | 41.1 | 6.5 |
| ---- Pioneer 846 ---- | | | | | | | | | |
| Colby | 0.014 | 0.28 | 0.13 | 0.35 | 0.002 | 17.5 | 39.4 | 12.8 | 5.6 |
| Garden City | 0.016 | 0.28 | 0.14 | 0.35 | 0.004 | 18.1 | 40.9 | 17.6 | 5.9 |
| Manhattan | 0.023 | 0.28 | 0.14 | 0.30 | 0.003 | 11.2 | 33.1 | 18.6 | 4.6 |
| Mound Valley | 0.011 | 0.22 | 0.11 | 0.28 | 0.003 | 15.2 | 32.6 | 17.8 | 4.2 |
| ---- Mixed ---- | | | | | | | | | |
| Colby | 0.019 | 0.30 | 0.14 | 0.36 | 0.030 | 12.2 | 92.7 | 6.8 | 3.4 |
| Garden City | 0.022 | 0.32 | 0.15 | 0.36 | 0.012 | 15.8 | 91.4 | 7.7 | 4.0 |
| Manhattan | 0.054 | 0.48 | 0.20 | 0.45 | 0.006 | 14.0 | 85.9 | 17.4 | 5.5 |
| Mound Valley | 0.019 | 0.42 | 0.15 | 0.32 | 0.003 | 10.3 | 38.7 | 8.5 | 3.4 |

1. Dry matter basis

2. Parts per million. 1 ppm = 0.0001%

3. Variety

Table 7. Minerals in Kansas Dryland Sorghum Forages¹

| Location | % Calcium | % Phosphorus | % Magnesium | % Potassium | % Sodium | ppm ² Manganese | ppm Iron | ppm Zinc | ppm Copper |
|--------------|-----------------------|-----------------|----------------|----------------|-------------|-------------------------------|-------------|-------------|---------------|
| Colby | 0.31±.03 ³ | 0.17±.01 | 0.17±.03 | 1.94±.13 | 0.007±.004 | 30.7±3.4 | 143±31 | 17.0±4.0 | 4.9±1.9 |
| Garden City | 0.25±.03 | 0.11±.02 | 0.20±.03 | 1.91±.16 | 0.003±.005 | 66.5±4.4 | 210±39 | 17.5±5.1 | 22.7±2.3 |
| Manhattan | 0.23±.02 | 0.12±.01 | 0.18±.02 | 1.50±.10 | 0.003±.003 | 33.6±2.8 | 135±25 | 18.6±3.2 | 6.1±1.5 |
| Mound Valley | 0.23±.02 | 0.15±.01 | 0.22±.02 | 0.86±.13 | 0.017±.003 | 29.0±2.9 | 121±27 | 46.3±3.4 | 19.5±1.6 |

1. Dry matter basis.

2. Parts per million. 1 ppm = .0001%

3. Average + standard deviation. Two thirds of the values under these conditions can be expected to fall within 1 standard deviation. For example, at Colby, two thirds of the values for calcium should fall within 0.31%±.03, or between 0.28% and 0.34%.

Table 8. Estimated Mineral Requirements
of Feed-lot Cattle.¹

| Mineral | Requirement |
|----------------|-------------|
| Calcium, % | 0.4 |
| Phosphorus, % | 0.3 |
| Magnesium, % | 0.1 |
| Potassium, % | 0.5 |
| Sodium, % | 0.2 |
| Manganese, ppm | 30 |
| Iron, ppm | 100 |
| Zinc, ppm | 60 |
| Copper, ppm | 10 |

¹Based on air-dry (.90% dry matter) feed.