Nutritive Value and Intake of Kleberg Blue-stem by Beef Cattle

M.E. PACHECO, R.D. BROWN, AND R.L. BINGHAM

Abstract

Four cuttings of Kleberg bluestem (\textit{Dicanthium annulatum}) were fed to 15 Santa Gertrudis steers to develop prediction equations for intake based on nutrient analyses of the forage with 4 replications. The 4 forages were found to differ in nutrient content ($P<.05$) and intake ($P<.005$). DE and DMD of Kleberg bluestem can be accurately predicted by laboratory means; however, prediction of intake of this forage with present analysis is impractical.

In order to adequately and economically supplement cattle on low quality pastures it is important to first ascertain the level of nutrients supplied by forage. Thus the ability to measure nutrients and predict the intake of low quality forage by grazing cattle is critical. Kleberg bluestem (\textit{Dicanthium annulatum}) is a common forage in the South Texas region. Previous studies (Hertel 1976) have found this forage to be of generally low nutrient content, and to exhibit a wider annual variation in DE than other local grasses.

The purpose of this study was to measure the intake of this forage in relation to its nutrient content in order to develop a predictive equation.

Materials and Methods

Kleberg bluestem was harvested from three different locations in South Texas. A fourth cutting was taken from regrowth in one location. After harvesting, the forages were stored as square bales. The hays were analyzed for TVDMD and found to be different ($P<.05$) in this aspect of their quality.

Sixteen Santa Gertrudis steers, with an average beginning weight of 204.3 kg, were maintained in a single 29 x 12 m pen. A shed at one end housed 16 Calan Electronic Feeding Gates\textsuperscript{1}, thus allowing individual feed intake to be measured on each animal. Water was available ad libitum.

During each of 4 2-week trials the steers were randomly divided into 4 treatment groups, each group assigned to one hay. The cattle were weighed before and after each trial and the average weight of each individual was used for intake calculations. The hays were chopped to a length of 315 cm \textit{ad libitum}. The amount of feed offered was measured daily while orts were collected weekly for the calculation of average daily feed intake per animal. During each trial, a 7-day adjustment period was followed by a 7-day collection period.

During each trial 1 steer in each of the 4 treatment groups was fitted with a fecal collection bag. Feces were collected and weighed, and aliquots were taken daily. Daily collections were combined at the end of the week and frozen until analysis.

Results and Discussion

The overall findings indicate that the nutritive value of this grass was low (Table 1). The results of the \textit{Proximate} and \textit{Van Soest} analyses are similar to those of other tropical grasses (Moore and Mott 1973) and to the results of Hertel (1976) of the analyses of 40 samples of Kleberg bluestem.

The digestibilities of all of the components determined on this forage were depressed (Table 2). This was probably a consequence of the high fiber and silica and low protein content of these forages. Tropical grasses tend to be lower in quality and digestibility than temperate grasses of the same maturity (Moore and Mott 1973). Van Soest and Jones (1967) reported a 3% decrease in digestibility for every 1% increase in silica content of forages. The nutritive value of the hays also affected intake, as the overall intake of the forages was less than 2.0% of the body weights of the steers throughout the experiment.

An analysis of variance showed the difference of the DMI/\textit{bw}\textsuperscript{75} of the 4 hays to be highly significant ($P<.005$). A multiple stepwise regression analysis regressing DMI/\textit{bw}\textsuperscript{75} on all 33 laboratory and digestibility variables resulted in the equation, DMI/\textit{bw}\textsuperscript{75} = .856 - .014 (DM) + .004 (NFE) + .007 (HEMI) + .015 (CPD) with $r^2=.38$.

Since in vivo CPD is an impractical value for routine analysis, an all possible subsets regression analysis was conducted utilizing 13 of the 33 variables. The 13 variables were selected for their ease of determination in the laboratory. The regression analysis yielded the prediction equation, \textit{DMI}/\textit{bw}\textsuperscript{75} = -551 + .015 (CP) - .006 (CP) - .019 (NDIASH) + .015 (LIG) + .010 (SIL) + .022 (HEMI).
Table 1. Analyses of 4 cuttings of Kleberg blue&em bay used in a feed intake experiment.

<table>
<thead>
<tr>
<th>Components</th>
<th>Text abbreviations</th>
<th>A</th>
<th>S.D.</th>
<th>B</th>
<th>S.D.</th>
<th>C</th>
<th>S.D.</th>
<th>D</th>
<th>S.D.</th>
<th>X</th>
<th>S.D. (%)</th>
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<tbody>
<tr>
<td>Dry matter</td>
<td>DM</td>
<td>89.3</td>
<td>.23</td>
<td>89.3</td>
<td>.53</td>
<td>89.5</td>
<td>.18</td>
<td>88.9</td>
<td>.47</td>
<td>89.3</td>
<td>.42</td>
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<tr>
<td>Crude protein</td>
<td>CP</td>
<td>4.2</td>
<td>.36</td>
<td>4.7</td>
<td>.51</td>
<td>4.0</td>
<td>.38</td>
<td>4.2</td>
<td>.05</td>
<td>4.0</td>
<td>.34</td>
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<tr>
<td>Ether extract</td>
<td>EE</td>
<td>2.5</td>
<td>.11</td>
<td>1.4</td>
<td>.14</td>
<td>8.0</td>
<td>.07</td>
<td>1.1</td>
<td>.50</td>
<td>1.4</td>
<td>.65</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>CF</td>
<td>19.8</td>
<td>.52</td>
<td>22.1</td>
<td>1.78</td>
<td>24.8</td>
<td>1.51</td>
<td>22.9</td>
<td>1.37</td>
<td>22.4</td>
<td>2.23</td>
</tr>
<tr>
<td>Ash</td>
<td>ASH</td>
<td>12.8</td>
<td>.11</td>
<td>10.7</td>
<td>.49</td>
<td>10.7</td>
<td>.72</td>
<td>9.8</td>
<td>.23</td>
<td>10.9</td>
<td>1.13</td>
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<td>Nitrogen free extract</td>
<td>NFE</td>
<td>60.7</td>
<td>.81</td>
<td>62.2</td>
<td>2.05</td>
<td>59.7</td>
<td>2.10</td>
<td>62.0</td>
<td>.99</td>
<td>61.2</td>
<td>1.92</td>
</tr>
</tbody>
</table>

Van Soest Analyses (%)

- Neutral detergent fiber (NDF)
- Cell contents (CC)
- Acid detergent fiber (ADF)
- Neutral detergent insoluble ash (NDIASH)
- Lignin (LIGN)
- Hemicellulose (HEMI)
- Silica (SIL)

Other Analyses

- Gross energy (Kcal/gm) (GE)
- Calcium (%) (Ca)
- Phosphorus (%) (P)
- Nitrate (ppm) (NIT)
- Density (g/cc) (DEN)

\[^{a} All values are on a dry matter basis, n = 4 samples of these hays for most analyses.\]
\[^{b} n=3 samples of this hay for most analyses.\]
\[^{c} n=1 sample of each hay was analyzed.\]

Table 2. Digestibility (%) and feed intake of 4 cuttings of Kleberg blue&em bay.

<table>
<thead>
<tr>
<th>Components</th>
<th>Text abbreviations</th>
<th>A</th>
<th>S.D.</th>
<th>B</th>
<th>S.D.</th>
<th>C</th>
<th>S.D.</th>
<th>D</th>
<th>S.D.</th>
<th>X</th>
<th>S.D.</th>
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<tbody>
<tr>
<td>Dry matter</td>
<td>DDM</td>
<td>46.85</td>
<td>4.48</td>
<td>36.27</td>
<td>5.73</td>
<td>45.63</td>
<td>2.57</td>
<td>38.44</td>
<td>7.17</td>
<td>41.80</td>
<td>6.77</td>
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<tr>
<td>Protein</td>
<td>DP</td>
<td>1.15</td>
<td>.16</td>
<td>35</td>
<td>.10</td>
<td>93</td>
<td>.30</td>
<td>71</td>
<td>.24</td>
<td>.79</td>
<td>.37</td>
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<tr>
<td>Ether extract</td>
<td>DEE</td>
<td>1.94</td>
<td>.26</td>
<td>96</td>
<td>.16</td>
<td>35</td>
<td>.17</td>
<td>60</td>
<td>.37</td>
<td>.96</td>
<td>.63</td>
</tr>
<tr>
<td>Crude Fiber</td>
<td>DF</td>
<td>10.40</td>
<td>1.19</td>
<td>9.40</td>
<td>.98</td>
<td>14.35</td>
<td>2.06</td>
<td>9.75</td>
<td>2.69</td>
<td>10.98</td>
<td>2.79</td>
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<tr>
<td>Nitrogen free extract</td>
<td>DNFE</td>
<td>38.46</td>
<td>3.91</td>
<td>34.82</td>
<td>4.97</td>
<td>36.61</td>
<td>2.22</td>
<td>35.10</td>
<td>3.41</td>
<td>36.10</td>
<td>3.83</td>
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<tr>
<td>Neutral detergent fiber</td>
<td>DNFDF</td>
<td>42.62</td>
<td>3.02</td>
<td>38.82</td>
<td>4.41</td>
<td>48.95</td>
<td>2.52</td>
<td>40.68</td>
<td>5.32</td>
<td>42.77</td>
<td>5.52</td>
</tr>
<tr>
<td>Cell contents</td>
<td>DCC</td>
<td>14.92</td>
<td>2.04</td>
<td>8.15</td>
<td>1.04</td>
<td>7.18</td>
<td>.28</td>
<td>8.75</td>
<td>2.18</td>
<td>9.25</td>
<td>3.23</td>
</tr>
<tr>
<td>Acid detergent fiber</td>
<td>DADF</td>
<td>20.87</td>
<td>2.16</td>
<td>19.60</td>
<td>3.28</td>
<td>27.21</td>
<td>2.71</td>
<td>22.39</td>
<td>4.36</td>
<td>22.24</td>
<td>4.33</td>
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<tr>
<td>Hemicellulose</td>
<td>DCELL</td>
<td>20.57</td>
<td>.96</td>
<td>20.15</td>
<td>2.32</td>
<td>26.48</td>
<td>1.33</td>
<td>21.90</td>
<td>2.51</td>
<td>22.28</td>
<td>3.16</td>
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<tr>
<td>In vitro dry matter digestibility</td>
<td>IVVMD</td>
<td>45.91</td>
<td>NA</td>
<td>33.37</td>
<td>NA</td>
<td>42.25</td>
<td>NA</td>
<td>40.59</td>
<td>NA</td>
<td>40.53</td>
<td>4.48</td>
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<tr>
<td>Energy (Mcal DE/kg)</td>
<td>DE</td>
<td>2.64</td>
<td>.14</td>
<td>1.90</td>
<td>.21</td>
<td>2.16</td>
<td>.15</td>
<td>1.86</td>
<td>.29</td>
<td>2.14</td>
<td>.58</td>
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<tr>
<td>Total digestible nutrients</td>
<td>TNDN</td>
<td>54.40</td>
<td>5.24</td>
<td>46.72</td>
<td>5.43</td>
<td>52.34</td>
<td>1.83</td>
<td>45.13</td>
<td>5.22</td>
<td>49.65</td>
<td>5.54</td>
</tr>
</tbody>
</table>

\[^{d} All values are on a dry matter basis.\]
\[^{e} n=4 steers for each hay for digestibility determinations.\]
\[^{f} n=16 steers for most hays for intake measurements.\]
\[^{g} n=12 steers for this hay for intake measurement.\]

Although the determination of TDN is often considered out-date, the measurement of TDN is of value for comparisons with older data on other forages. The results of an all possible subsets regression of TDN on the 13 variables resulted in the equation, TDN = -626.178 + 7.320 (DM) - 562 (IVVMD) and an $r^2$ of .56. The relatively low $r^2$ of this equation is consistent with other attempts to predict TDN values in forages (Butterworth and Diaz 1969).

Finally, an all possible subsets regression analysis was made to predict the DMD from the 13 variables. The resulting equation was DMD = -1167.600 + 12.430 (DM) + 1556 (CF) - 4.791 (ASH) +
1.286 (IVDMD) + 737.273 (DEN) with r² = .82. This equation may be more useful than that of Rama Rao et al. (1972), whose equation for in vitro DMD = -77.56 + 1.711 (CP) + 4.7(ADF) - .05 (ADF²) with an r² = .87, of that of Paquay et al. (1971), whose equation for the prediction of in vivo DMD, DMD = 89.58 - .557 (DE) - .863 (CF) had an r² of .67 and required of the determination of actual digestible energy.

In conclusion, the low r² for both equations predicting DMI/bw⁰·⁰⁵ indicate that the dry matter intake of this forage cannot be practically predicted from either routine or extensive laboratory analyses currently in use. The relatively high r² for the equations predicting DE and DMD indicate that these parameters can be estimated from analyses commonly done in forage testing laboratories. One must be cautious about applying these prediction equations to other forages or even higher quality samples of Kleberg bluestem. In an area where this forage is abundant and if universally low quality, however, such equations may be useful.

**Literature Cited**


