Performance of Tall Fescue Varieties [1984]

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PERFORMANCE OF TALL FESCUE VARIETIES

R. C. Buckner, P. B. Burrus, II, Nelson Gay, J. A. Boling, and Garry Lacefield

The objective of the tall fescue breeding program is the development of varieties characterized by superior nutritive value (including reduced contents of perloline and loline alkaloids and the fungal endophyte, Epichloë typhina, (Acremonium coenophialum)), palatability, disease resistance, and adaptation through the utilization of intergeneric and interspecific hybrid derivatives of ryegrass and tall fescue species. Varieties previously released from the breeding program were Kentucky 31, Kenwell, and Kenhy. Johnstone tall fescue, developed cooperatively by the Kentucky Agricultural Experiment Station and USDA-ARS, was released March 1, 1982, as a new variety. Johnstone is characterized as having low levels of perloline alkaloid and the fungal endophyte, Acremonium coenophialum, and improved forage quality during summer. It is expected that seed of Johnstone will be available commercially during 1985, and a good supply should be available for spring and summer 1986 planting.

Tall fescue varieties are evaluated in pure stands seeded in the fall at the rate of 15 lbs/acre. The varieties are evaluated under the following two management systems that are widely used in Kentucky: (1) hay and pasture; and (2) seed and stockpiled forage.

Yields

Forage - While yield is an important characteristic of tall fescue, it is not considered to be a critical problem of the species. In the evaluation of varieties, the variety Kentucky 31 is used as the standard check, as it is the major variety used in Kentucky and the central United States. New varieties are considered to be satisfactory for yield and adaptation when they equal the performance of Kentucky 31.

Yields are determined by taking a hay harvest when the grass is in the boot stage of maturity. To simulate pasture conditions, aftermath growth is harvested each 4 to 6 weeks during the remainder of the growing season. Hay and pasture management includes fertilization at the rate of 100 lb/acre ammonium nitrate in March, June, and September. Forage dry matter yields are presented in Table 1.
Seed production management involves harvesting the varieties for seed in June, removing the forage in August, and permitting growth until frost, to simulate stockpiling forage for winter use. Grass in this management system is fertilized with 200 lb/acre ammonium nitrate approximately September 1 and again December 1. Yields of clean seed/acre are presented in Table 2.

Forage Quality

Tall fescue is a well adapted, widely used pasture species occupying six million acres in Kentucky and 25-35 million acres in the South Central United States. Thus, it is an extremely desirable cool-season species for this region. Animal response from grazing tall fescue during summer is erratic, however, because of forage quality problems. Criteria used to determine forage quality are acceptability, intake, and digestibility.

The variety Kenhy was the first tall fescue variety to be developed utilizing ryegrass-tall fescue hybrids. Kenhy is characterized by superior forage quality, disease resistance and yield, and wide adaptation. Comparative performance data for Kenhy are presented in Table 3. The Johnstone variety is characterized by improved forage succulence during drought, palatability and low levels of perloline (an alkaloid that inhibits digestibility in ruminants). A seed certification program is approved requiring seed of Johnstone to have low level fungal endophyte, *A. coenophialum* infection. This endophytic fungus is transmitted exclusively through tall fescue seed. The endophyte and/or perloline alkaloid severely inhibits the performance of cattle grazing on tall fescue during summer. Comparisons of Johnstone with Kenhy and Kentucky 31, for color, palatability and perloline content are presented in Tables 4-6.
## Table 1. Forage Dry Matter Yields of Tall Fescue Varieties Evaluated in Tests at Lexington From 1976 Through 1983.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenhy</td>
<td>2.9</td>
<td>3.5</td>
<td>2.2</td>
<td>2.1</td>
<td>3.0</td>
<td>3.9</td>
</tr>
<tr>
<td>Ky. 31</td>
<td>2.6</td>
<td>3.4</td>
<td>2.2</td>
<td>2.3</td>
<td>3.0</td>
<td>3.8</td>
</tr>
<tr>
<td>MO. 96</td>
<td>2.5</td>
<td>3.5</td>
<td>2.0</td>
<td>2.3</td>
<td>3.0</td>
<td>3.9</td>
</tr>
<tr>
<td>Forager</td>
<td></td>
<td></td>
<td></td>
<td>2.3</td>
<td>3.0</td>
<td>3.7</td>
</tr>
<tr>
<td>Johnstone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.9</td>
</tr>
<tr>
<td>AU-Triumph</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.7</td>
</tr>
</tbody>
</table>

Six separate forage dry matter yields tests are summarized above. In the first column, the 1976-78 figures give the year of harvest of a trial seeded in the fall of 1975. The other tests were seeded in subsequent years.

## Table 2. Clean Seed Yields of Tall Fescue Varieties Evaluated in Tests at Lexington From 1976 Through 1983.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenhy</td>
<td>318</td>
<td>552</td>
<td>348</td>
<td>333</td>
<td>522</td>
<td>798</td>
</tr>
<tr>
<td>Ky. 31</td>
<td>315</td>
<td>509</td>
<td>268</td>
<td>424</td>
<td>531</td>
<td>681</td>
</tr>
<tr>
<td>MO. 96</td>
<td>165</td>
<td>347</td>
<td>226</td>
<td>234</td>
<td>382</td>
<td>540</td>
</tr>
<tr>
<td>Forager</td>
<td></td>
<td></td>
<td></td>
<td>333</td>
<td>360</td>
<td>318</td>
</tr>
<tr>
<td>Johnstone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>688</td>
</tr>
<tr>
<td>AU-Triumph</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>143</td>
</tr>
</tbody>
</table>

Six separate tests are summarized above. In the first column, the 1976-78 figures give the year of harvest of a trial seeded in the fall of 1975. The other tests were seeded in subsequent years.
Table 3. Agronomic and Forage Quality Characteristics of Kenhy and Kentucky 31 Tall Fescue at Lexington (1970-75).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Variety</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kenhy</td>
</tr>
<tr>
<td>Leaf roll during drought (%)</td>
<td>53</td>
</tr>
<tr>
<td>Color(^1)</td>
<td>1.2</td>
</tr>
<tr>
<td>Digestibility</td>
<td>66.4</td>
</tr>
<tr>
<td>Lignin (% of dry matter)</td>
<td>1.9</td>
</tr>
<tr>
<td>Palatability grazed by sheep (%)</td>
<td>67.3</td>
</tr>
<tr>
<td>Palatability rating during summer(^2)</td>
<td>4.0</td>
</tr>
</tbody>
</table>

\(^1\) = green; 9 = brown. Figures are means of ratings during various seasons of the year.

\(^2\) Free-choice cattle grazing trials: 1 = best grazed, 9 = ungrazed.

Table 4. Seasonal Color Scores of Kenhy, Johnstone and Kentucky 31 Tall Fescue.\(^1\)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Test 109 1978</th>
<th>Test 107 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>March</td>
<td>July</td>
</tr>
<tr>
<td>Kenhy</td>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Johnstone</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Ky. 31</td>
<td>5.0</td>
<td>8.5</td>
</tr>
<tr>
<td>L.S.D. 0.05</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>C.V. (%)</td>
<td>26</td>
<td>33</td>
</tr>
</tbody>
</table>

\(^1\) = green; 9 = brown.
Table 5. Palatability Scores of Kenhy, Johnstone, and Kentucky 31 Varieties When Grazed Free-Choice with Cattle.  

<table>
<thead>
<tr>
<th>Variety</th>
<th>Test No.</th>
<th>108</th>
<th>110</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1975</td>
<td>1976</td>
</tr>
<tr>
<td>Kenhy</td>
<td></td>
<td>4.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Johnstone</td>
<td></td>
<td>2.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Ky. 31</td>
<td></td>
<td>6.0</td>
<td>6.5</td>
</tr>
<tr>
<td>L.S.D. 0.05</td>
<td></td>
<td>2.1</td>
<td>1.8</td>
</tr>
<tr>
<td>C.V. (%)</td>
<td></td>
<td>44</td>
<td>33</td>
</tr>
</tbody>
</table>

1/1 = best grazed; 9 = ungrazed.

Table 6. Perolone Alkaloid Levels During Summer of Kenhy, Johnstone and Kentucky 31 Tall Fescue.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Season</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1975</td>
</tr>
<tr>
<td>Kenhy</td>
<td>1000</td>
</tr>
<tr>
<td>Johnstone</td>
<td>318</td>
</tr>
<tr>
<td>Ky. 31</td>
<td>-</td>
</tr>
<tr>
<td>L.S.D. 0.05</td>
<td>295</td>
</tr>
<tr>
<td>C.V. (%)</td>
<td>16</td>
</tr>
</tbody>
</table>
Animal Performance

The ability of tall fescue to provide the nutrient requirements for specific levels of performance by animals is perhaps the best measure of forage quality. Many animal performance studies on tall fescue pastures, both in pure and mixed seedings and in fescue-legume mixtures, have shown performance to be superior in some tests but inferior in others, in comparison to performance with other grasses.

Poor performance of animals grazing tall fescue corresponds in time (July, August, and September) to the greater accumulation of the perloline alkaloid and the fungal endophyte during July-September. Perloline inhibits digestibility in ruminants and the endophyte is associated with reduced forage intake. Kenhy has perloline levels comparable to those of Kentucky 31. Seed may be obtained of Kenhy that is certified as having low levels of A. coenophialum.

Comparative performance of cattle grazing pure stands of Kentucky 31 and Kenhy tall fescue is presented in Tables 7 thru 9. The effect of the fungal endophyte, A. coenophialum, on animal performance is reflected in data presented in Table 9. This is the only test in which the level of infection with the fungus was known. Animal performance presented in Tables 7 and 8 may have been influenced by variable levels of endophyte infection of the two varieties.
Table 7. Productivity of Cattle on Kenhy and Kentucky 31 Tall Fescue Varieties.

<table>
<thead>
<tr>
<th>Location*</th>
<th>Years</th>
<th>Total Days</th>
<th>Season</th>
<th>Average Daily Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Kenhy</td>
</tr>
<tr>
<td>Georgia</td>
<td>1974-75</td>
<td>212</td>
<td>Winter</td>
<td>0.8</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>1974-75</td>
<td>134</td>
<td>Winter</td>
<td>0.3</td>
</tr>
<tr>
<td>Missouri</td>
<td>1974-75-76</td>
<td>336</td>
<td>Summer</td>
<td>1.3</td>
</tr>
<tr>
<td>Illinois</td>
<td>1975</td>
<td>189</td>
<td>Summer</td>
<td>0.7</td>
</tr>
<tr>
<td>Virginia</td>
<td>1972-73-74</td>
<td>-</td>
<td>Summer</td>
<td>0.8</td>
</tr>
<tr>
<td>Arkansas</td>
<td>1980-81</td>
<td>266</td>
<td>Summer</td>
<td>1.1</td>
</tr>
</tbody>
</table>

*Data provided by Dr. R. S. Lowry, Dr. H. G. Williams, Dr. A. G. Matches, Dr. C. J. Kaiser, Dr. H. T. Bryant, and Dr. J. W. Spears, from the respective locations.

Table 8. Average Daily Gains of Steers at Princeton During 1977.*

<table>
<thead>
<tr>
<th>Variety</th>
<th>Apr. 1-June 14</th>
<th>July 7-Aug. 1</th>
<th>Sept. 26-Nov. 23</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ky. 31</td>
<td>1.9</td>
<td>0.9</td>
<td>1.1</td>
<td>1.3</td>
</tr>
<tr>
<td>Kenhy</td>
<td>1.7</td>
<td>1.3</td>
<td>1.8</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Table 9. Performance of Yearling Steers Grazing Kentucky 31 and Yearling Heifers Grazing Kenhy Tall Fescue at Western Kentucky Agricultural Experiment Station, Princeton, Ky.¹

<table>
<thead>
<tr>
<th>Variety</th>
<th>Year</th>
<th>No. Cattle</th>
<th>Days Grazed</th>
<th>Initial Weight</th>
<th>Avg. Daily Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ky 31²/</td>
<td>1981</td>
<td>10</td>
<td>84</td>
<td>565</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>1982</td>
<td>8</td>
<td>116</td>
<td>629</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 yr average</td>
<td></td>
<td></td>
<td>0.82¹</td>
</tr>
<tr>
<td>Kenhy³/</td>
<td>1981</td>
<td>16</td>
<td>84</td>
<td>595</td>
<td>1.40</td>
</tr>
<tr>
<td></td>
<td>1982</td>
<td>16</td>
<td>116</td>
<td>550</td>
<td>1.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 yr average</td>
<td></td>
<td></td>
<td>1.37</td>
</tr>
</tbody>
</table>

¹Cattle were on nitrogen fertilized grass throughout the grazing season. Forage availability was not limiting to either group.

²Kentucky 31 heavily infected (>95%) with Acremonium coenophialum.

³Kenhy had low-level (<5%) infection of Acremonium coenophialum.