Good quality forages are the main asset of any livestock operation and are crucial for the livestock industry. In general, performance of grazing animals reflects forage quality. Forages contain nutrients that affect individual animal production (gain per animal) while the amount of forage produced affects production per acre.

You should make the decision whether to use conserved forage, such as hay, or to allow livestock to graze standing forages, as well as decisions around the selection and purchasing of hay, based on forage quality.

Forage analyses are important because they describe the forage quality. Forage testing is also a relatively inexpensive tool in your toolbox when estimating the nutritive value of forage to be grazed, hayed, purchased or marketed. Knowing what affects forage quality will also help in making appropriate selections of forages and supplements, resulting in economically optimum livestock performance.

WHEN AND WHAT TO SAMPLE
Always try to sample the forage in question as near to the time of feeding or sale as possible.

Allow for enough time for the sample to be processed by the laboratory. This could range from one day to several weeks, depending on the tests requested, methods used and number of samples tested.

Extreme variation can occur in forage quality when harvested from the same field or lot of hay, etc.

There is a wealth of instructional information available.
Table 1. Moisture and dry matter concentration of different forms of forage (University of Florida-IFAS Extension Bulletin SS-AGR-322).

<table>
<thead>
<tr>
<th>Type</th>
<th>Moisture*</th>
<th>Dry Matter*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hay</td>
<td>8-15</td>
<td>85-92</td>
</tr>
<tr>
<td>Silage</td>
<td>65-75</td>
<td>25-45</td>
</tr>
<tr>
<td>Fresh forage</td>
<td>70-85</td>
<td>15-30</td>
</tr>
</tbody>
</table>

*percentage

SUBMITTING A SAMPLE FOR TESTING
Fill out the form available at www.noble.org/forage-sampling. Identify the sample so that it is clear which forage it represents. Indicate what plant (bermudagrass, native grasses, alfalfa, etc.) and type (hay, standing forage, silage) of forage it is. This information allows for a more precise analysis and more accurate supplementation recommendations.

COMPONENTS OF FORAGE QUALITY
Normally, four measurements are taken for forage quality analyses:
- Moisture.
- Crude protein (CP).
- Neutral detergent fiber (NDF).
- Acid detergent fiber (ADF).

Other forage quality components are calculated from these measured attributes, as shown in Figure 1.

MOISTURE (%)
Moisture content of the forage sample is usually reported in a wet and a dry matter (DM) basis. Wet basis indicates how much fresh forage would be required to meet the DM requirements of the livestock. Dry matter is calculated as if the forage had no water content. This calculation allows for the most accurate comparison among different forages. It will also vary depending on forage type and how the forage is fed (Table 1).

CRUDE PROTEIN (CP, %)
Proteins are the most important nutrients for livestock. These nutrients support microbe activity in breaking down forage in the rumen. Proteins make up 60-80% of the total plant nitrogen. Proteins also contribute essential amino acids for the animal itself. Crude protein is an indirect measure of the nitrogen (N) concentration of the forage multiplied by 6.25. This calculation assumes that N constitutes about 16% of protein in the leaf and stem of the forage plant (100 ÷ 16 = 6.25).

NEUTRAL DETERGENT FIBER (NDF, %)
NDF represents the total fiber fraction of the forage. Three fiber fractions make up the structural cell wall in a plant. These fractions are cellulose, hemicellulose, and lignin. Values can range from 10% in grain to 80% in grass straw. NDF values for grasses are higher when compared to legumes. A high NDF content indicates a high fiber content in the forage. Therefore, the lower the NDF value of the forage sample, the better.
Table 2. Effect of maturity in alfalfa on CP, ADF, NDF and RFV (adapted from Oklahoma Cooperative Extension Service Bulletin PSS-2117).

<table>
<thead>
<tr>
<th>Stage of Maturity</th>
<th>CP%</th>
<th>ADF%</th>
<th>NDF%</th>
<th>RFV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bud</td>
<td>25</td>
<td>28</td>
<td>38</td>
<td>164</td>
</tr>
<tr>
<td>Early bloom</td>
<td>23</td>
<td>30</td>
<td>40</td>
<td>125</td>
</tr>
<tr>
<td>Mid bloom</td>
<td>19</td>
<td>35</td>
<td>46</td>
<td>125</td>
</tr>
<tr>
<td>Full bloom</td>
<td>16</td>
<td>41</td>
<td>53</td>
<td>100</td>
</tr>
</tbody>
</table>

Additionally, conditions during harvest or poor storage practices can adversely affect forage quality by allowing the breakdown of soluble sugars. Other factors, such as harvest management practices, soil fertility levels, plant diseases and time of season can all affect forage quality.

Knowing what affects forage quality and how to interpret a forage quality test will aid in forage selection and supplements that will help match animal requirements and economically improve livestock performance.