California Forage Quality—From Grass to Poop
How Does the Grass Grow?

SFREC Forage Growth by Month

<table>
<thead>
<tr>
<th>Month</th>
<th>lbs/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec</td>
<td></td>
</tr>
<tr>
<td>Jan</td>
<td></td>
</tr>
<tr>
<td>Feb</td>
<td></td>
</tr>
<tr>
<td>Mar</td>
<td></td>
</tr>
<tr>
<td>Apr</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>3000</td>
</tr>
<tr>
<td>Peak</td>
<td>3000</td>
</tr>
</tbody>
</table>
# Table 1. Crude protein content of annual grasses, filaree, and bur clover at seven stages of maturity

<table>
<thead>
<tr>
<th></th>
<th>Annual Grass</th>
<th>Filaree</th>
<th>Bur Clover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early vegetative</td>
<td>18</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>Late vegetative</td>
<td>15</td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>Early flowering</td>
<td>15</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>Late flowering</td>
<td>10</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>Mature</td>
<td>6</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>Dry</td>
<td>5</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>Dry, leached</td>
<td>3</td>
<td>5</td>
<td>17</td>
</tr>
</tbody>
</table>

Source: Hart et al. 1932; Gordon and Sampson 1939
## Energy Quality – the Grass Side

<table>
<thead>
<tr>
<th>Stage of maturity</th>
<th>Metabolizable energy (Mcal/kg)</th>
<th>TDN (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Annual grass</td>
<td>Filaree</td>
</tr>
<tr>
<td>Early vegetative</td>
<td>2.8</td>
<td>3.5</td>
</tr>
<tr>
<td>Late vegetative</td>
<td>2.7</td>
<td>3.4</td>
</tr>
<tr>
<td>Early flowering</td>
<td>2.6</td>
<td>3.3</td>
</tr>
<tr>
<td>Late flowering</td>
<td>2.4</td>
<td>3.0</td>
</tr>
<tr>
<td>Mature</td>
<td>2.2</td>
<td>2.6</td>
</tr>
<tr>
<td>Dry</td>
<td>2.1</td>
<td>2.5</td>
</tr>
<tr>
<td>Dry, leached</td>
<td>2.1</td>
<td>2.4</td>
</tr>
</tbody>
</table>
Quality – The Grass Side

The graph shows the crude protein (%) of grass throughout the year for different regions:
- **Northern** (solid black squares)
- **Central** (dashed lines with open triangles)
- **Southern** (solid grey circles)

The graph indicates a decline in crude protein from January to December for all regions, with the Northern region showing the highest values and a slower decline compared to the Central and Southern regions.
## Water Content

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Apr</th>
<th>Aug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rose Clover</td>
<td>77-83%</td>
<td>21-28%</td>
<td>0-4%</td>
</tr>
<tr>
<td>Annual Grass</td>
<td>72-79%</td>
<td>32-40%</td>
<td>0-5%</td>
</tr>
<tr>
<td>Filaree</td>
<td>75-84%</td>
<td>22-25%</td>
<td></td>
</tr>
</tbody>
</table>
Forage Sampling 1996-1999
Campbell Pasture - SFREC

Average Crude Protein %

Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

% CP

0.0  5.0  10.0  15.0  20.0  25.0
Forage Quality – Energy – Campbell Pasture 1996-99

Energy - NEm (Mca/kg)
NIRS/NUTBAL
Nutritional Management System

Detection
Prediction
Action
Follow-up
HANDPLUCKING...Human Perception of an Animal’s Diet

Visit all the major grazing sites within the landscape

Select the proper proportions of the different plant species

Get the plant parts selected correctly

Mix the various components of the diet in the proper sequence to get the proper associative effects
Fecal Chemistry
=CH2, =CH3, =C=O=C=,
Amide, Amine, Aromatics,
Protein Bonds, Peroxides,
=CH3-N, Alphatics

Predicted Diet
Crude Protein
Digestible Organic Matter
Phosphorus, etc

Diet Quality
Crude Protein
Dig. Org. Matter
Phosphorus, etc

DIET:FECAL PAIRS

NIR Spectra

Waveform transformation and statistical analysis is used to create a calibration equation to predict components
Sample Arrives and is assigned id #

Insulated mailer, ice pack, sample envelope, drying trays

Fresh feces placed in oven overnight

Dried feces is ground in cyclone mill next morning

NIRS Fecal Profiling Laboratory Procedures

NIRS quartz lens sample cups are packed

Sample scanned with NIR spectrophotometer

Results logged in database and spatially referenced in ARCVIEW
Calibration Reference Sets Used in the USA System:

Subtropical savanna of South Texas
Mixed hardwood/grasslands of East Central Texas
Mesquite-mixed grass savanna of North Texas
Tall and mid-grass prairie of Oklahoma
Derived cool-season pastures in west-central Missouri
Sandhill uplands and meadows of Nebraska
Mixed grass prairies of eastern Montana/ Central Dakotas
Derived cool-seasons pastures in south-central Canada
Other calibrations sets have been selectively used as well:

Argentina grasslands and shrublands
Sub-sahelian Africa (East and West)
Australian tropical woodlands
Ranches Participating in NIRS/NRCS National Nutrition Project

April 1997 - December 1998
Relationship of NEm To Required and Available Degradable Protein - Campbell Area

![Graph showing the relationship between NEm and Degradable Protein per day with months of the year on the x-axis and NEm and Degradable Protein per lb on the y-axis. The graph has three lines: one for Available, one for Reg, and one for Nem. The graph indicates percentage differences in Nem across different months: -22% in Aug, -32% in Sep, and -46% in Dec.](image-url)
Relationship of NEm to Required and Available Degradable Protein - Tehama County

Degradable Protein (lbs / day)

NEm (MCAL / lb)

Avail  Reg  Nem

- 22%  - 36%  - 46%
MARKETING OPTIONS:
Sell Weaned Calves
- Private Treaty
- Sale Yard
- Project Calves
- Internet
- Stockers
- Backgrounder
Sell Cull Cows & Bulls
Sell Individuals direct to consumers
Retain Ownership
- As Project Calves
- As Stockers
- As Backgrounder
- As Cull Cows & Bulls
- To Feedlot
- To Packer or Abattoir

Grain-fed Program
- Ranch Raised to Fatten
- Sell to Feedlot

Grass-fed Program (Natural/Organic)
- Ranch Raised to Fatten
- Retain to Grass-fed Weight
- Sell to Packer or Abattoir

Feedlot
- Grass-fed to Fed Weight
- Sell to Packer or Abattoir

Cut & Wrap (Processor)
- Subprimal
- Portioned
- Fresh or Frozen

Abattoir (Slaughter)
- Harvest
- Whole Carcass
- Half/Quarter Carcass
- Primal & Subprimal
- Fresh

Packer or Packing House/Plant

Consumer Sources
- E-mail or Mail Order
- On Ranch
- Health Food Store
- Farmer’s Market

(USDA Inspected Slaughter)
(Transportation)

Feedlot
(Transportation)

Distributor (Pass Thru)

Restaurant

Retail Grocery

Meat Market

Fresh Product

Fresh Product

Frozen Product

Restaurants

Retail Grocery

Meat Market

Consumer Direct

(County Health Inspected)

(USDA Inspected Cut & Wrap)
Height of Manure Piles
August 2002
GAN Crude Protein % = 8.5%
Height of Manure Piles

January 2003
GAN Crude Protein % = 15.1%
Height of Manure Piles

March 2003
GAN Crude Protein % = 17.4%