Forage Systems for Dairy Grazing

Robert Kallenbach
University of Missouri
Pasture-based Systems often appear Complex
Concepts

- Simple... Allows owner to manage and grow scale
- Repeatable... Must work across a wide variety of conditions
- Profitable... Have to make $ to remain in business
Production Planning

• A pretty ordinary thing in successful business models
Key Factors for Managing Forage Systems

- Understand what nutrients your cows need and when they need them
  - Calving season of most importance
- Select forages that fit your climate, soils, calving season
  - Prepare a pasture growth budget
  - Develop plans for forage growth deficits and excesses
  - Monitor production frequently
- Optimize quality by grazing management
  - Turn in at ~2750 lb/acre for most species
  - Turn out at ~1150 lb/acre for most species
Monthly Dry Matter Demand

100 cow herd – 1,200 lb cows – 13,000 lb milk/cow/yr

15 Feb. Calving

15 Sept. Calving

Calve all the time
Cool Season Grasses

- Tall Fescue
- Perennial Ryegrass
- Orchardgrass

Forage Growth Rate

Feb Apr Jun Aug Oct Dec
Perennial Ryegrass

- Medium to high yield potential
- Fair to poor persistence (2 to 4 yrs.)
- Fair tolerance to:
  - poor drainage
  - low soil fertility
- Poor tolerance to:
  - drought
  - heat stress
  - cold temperatures
- Forage quality good to excellent if managed
Orchardgrass

- Medium to high yield potential
- Medium persistence (3-5 yrs.)
- Good tolerance to:
  - cold temperatures
- Fair tolerance to:
  - poor drainage
  - low soil fertility
  - drought
  - heat stress
- Forage quality can be good but matures early
Tall Fescue

- Medium to high yield potential
- Medium persistence
- Good tolerance to:
  - cold temperatures
  - poor drainage
- Fair tolerance to:
  - low soil fertility
  - drought
  - heat stress
- Good forage quality but problems with E+ types formidable
# Milk Production from Tall Fescue

<table>
<thead>
<tr>
<th>Type</th>
<th>Intake lb/d</th>
<th>Milk Yield lb/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>KY 31 Infected</td>
<td>15.6</td>
<td>34.3</td>
</tr>
<tr>
<td>KY 31 Uninfected</td>
<td>20.0</td>
<td>43.1</td>
</tr>
</tbody>
</table>

Strahan et al., 1987
## Cool-Season Grasses:
### Species or Management?

<table>
<thead>
<tr>
<th>Type</th>
<th>-- Initial Height --</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6-10</td>
</tr>
<tr>
<td>milk (lb/day)</td>
<td></td>
</tr>
<tr>
<td>Tall Fescue (EF)</td>
<td>58.0</td>
</tr>
<tr>
<td>Orchardgrass</td>
<td>58.2</td>
</tr>
<tr>
<td>Perennial Ryegrass</td>
<td>59.2</td>
</tr>
</tbody>
</table>

Summary of five studies
Cool Season Grass with Legumes

- Cool season grass
- Red Clover
- White Clover
- Lespedeza

Forage Yield

Feb  Apr  Jun  Aug  Oct  Dec
Cool Season Grass with Alfalfa

- Cool season grass
- Alfalfa

Forage Yield

- Feb
- Apr
- Jun
- Aug
- Oct
- Dec
The Benefit of Legumes in Grass Pastures

![Graph showing the benefit of legumes in grass pastures over a period from March to November. The graph compares Orchardgrass and Orchardgrass + Clover, with milk production measured in pounds per day.]
Allocation of Pasture for Dairy Cattle

![Graph showing lb milk/day and lb/acre of DM at turn in over the months April to August for different pasture allocations: 2500, 3500, and 4500 lb/acre of DM.](image)
Length of Rotation Matters

Days on Pasture

lb milk/day
Pasture Budgeting

• What do you expect from your pasture?
  – When do you expect to get it?
  – How do you plan to deal with deficits in forage production?
  – How are you going to deal with excess forage production?
# Perennial Ryegrass/Clover

## Monthly Forage Balance

<table>
<thead>
<tr>
<th></th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perennial Ryegrass/Clover</td>
<td>4</td>
<td>97</td>
<td>168</td>
<td>86</td>
<td>39</td>
<td>11</td>
<td>51</td>
<td>33</td>
</tr>
<tr>
<td>Forage Needed by Herd</td>
<td>49</td>
<td>54</td>
<td>67</td>
<td>70</td>
<td>67</td>
<td>63</td>
<td>61</td>
<td>58</td>
</tr>
<tr>
<td>Forage Surplus/Deficit</td>
<td>-45</td>
<td>43</td>
<td>101</td>
<td>16</td>
<td>-28</td>
<td>-52</td>
<td>-10</td>
<td>-25</td>
</tr>
</tbody>
</table>

- Perennial ryegrass/clover – 100 acres
  - 5 t/a
- Stocking rate: 100 milking cows on 100 acres
- 15 Feb calving
- 10 lb grain/day
- 13,000 lb annual milk

Forage balance = 1 tons
Excess to be harvested = 160 tons
Excess to be fed back = 159 tons
## Orchardgrass/ Clover

<table>
<thead>
<tr>
<th>Monthly Forage Balance</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage Surplus/Deficit</td>
<td>-44</td>
<td>35</td>
<td>87</td>
<td>35</td>
<td>-22</td>
<td>-38</td>
<td>9</td>
<td>-17</td>
</tr>
<tr>
<td>Forage Needed by Herd</td>
<td>49</td>
<td>54</td>
<td>67</td>
<td>70</td>
<td>67</td>
<td>63</td>
<td>61</td>
<td>58</td>
</tr>
<tr>
<td>Orchardgrass/Clover</td>
<td>5</td>
<td>89</td>
<td>154</td>
<td>105</td>
<td>45</td>
<td>25</td>
<td>70</td>
<td>41</td>
</tr>
</tbody>
</table>

- Orchardgrass/clover – 100 acres
  - 5.5 t/a
- Stocking rate: 100 milking cows on 100 acres
- 15 Feb calving
- 10 lb grain/day
- 13,000 lb annual milk

Forage balance = 44 tons
Excess to be harvested = 166 tons
Excess to be fed back = 122 tons
Tall fescue (non-toxic)/ Clover

<table>
<thead>
<tr>
<th>Monthly Forage Balance</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
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<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tall fescue/clover</td>
<td>9</td>
<td>78</td>
<td>167</td>
<td>114</td>
<td>61</td>
<td>11</td>
<td>67</td>
<td>75</td>
</tr>
<tr>
<td>Forage Needed by Herd</td>
<td>49</td>
<td>54</td>
<td>67</td>
<td>70</td>
<td>67</td>
<td>63</td>
<td>61</td>
<td>58</td>
</tr>
<tr>
<td>Forage Surplus/Deficit</td>
<td>-40</td>
<td>24</td>
<td>100</td>
<td>44</td>
<td>-6</td>
<td>-52</td>
<td>6</td>
<td>17</td>
</tr>
</tbody>
</table>

Forage balance = 93 tons
Excess to be harvested = 191 tons
Excess to be fed back = 98 tons

- Tall fescue/clover - 100 acres - 6.0 t/a
- Stocking rate: 100 milking cows on 100 acres
- 15 Feb calving
- 10 lb grain/day
- 13,000 lb annual milk
Nitrogen for Cool-season grasses

April

June

August

October

Forage Yield

Mostly Unneeded

Likely Profitable
Orchardgrass + 60 lb/ N in Early Spring

<table>
<thead>
<tr>
<th></th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Orchardgrass + N</strong></td>
<td>5</td>
<td>139</td>
<td>214</td>
<td>115</td>
<td>45</td>
<td>25</td>
<td>70</td>
<td>41</td>
</tr>
<tr>
<td><strong>Forage Needed by Herd</strong></td>
<td>49</td>
<td>54</td>
<td>67</td>
<td>70</td>
<td>67</td>
<td>63</td>
<td>61</td>
<td>58</td>
</tr>
<tr>
<td><strong>Forage Surplus/Deficit</strong></td>
<td>-44</td>
<td>85</td>
<td>147</td>
<td>45</td>
<td>-22</td>
<td>-38</td>
<td>9</td>
<td>-17</td>
</tr>
</tbody>
</table>

- **Orchardgrass** – 100 acres – 6.5 t/a
- Stocking rate: 100 milking cows on 100 acres
- 15 Feb calving
- 10 lb grain/day
- 13,000 lb annual milk

Forage balance = 165 tons
Excess to be harvested = 286 tons
Excess to be fed back = 121 tons
### Orchardgrass + 60 lb/ N in August

#### Monthly Forage Balance

<table>
<thead>
<tr>
<th></th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
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<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Orchardgrass</strong></td>
<td>5</td>
<td>89</td>
<td>154</td>
<td>105</td>
<td>45</td>
<td>50</td>
<td>95</td>
<td>71</td>
</tr>
<tr>
<td><strong>Forage Needed by Herd</strong></td>
<td>49</td>
<td>54</td>
<td>67</td>
<td>70</td>
<td>67</td>
<td>63</td>
<td>61</td>
<td>58</td>
</tr>
<tr>
<td><strong>Forage Surplus/Deficit</strong></td>
<td>-44</td>
<td>35</td>
<td>87</td>
<td>35</td>
<td>-22</td>
<td>-13</td>
<td>34</td>
<td>13</td>
</tr>
</tbody>
</table>

- Orchardgrass - 100 acres - 6.3 t/a
- Stocking rate: 100 milking cows on 100 acres
- 15 Feb calving
- 10 lb grain/day
- 13,000 lb annual milk

Forage balance = 125 tons
Excess to be harvested = 204 tons
Excess to be fed back = 79 tons
Warm Season Grasses

- Crabgrass
- Bermudagrass
- Caucasian bluestem
- Cool season grass

Forage Yield

Feb Apr Jun Aug Oct Dec
# Milk Production from Warm-Season Grasses

<table>
<thead>
<tr>
<th>Type</th>
<th>Milk Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bermudagrass</td>
<td>47.0</td>
</tr>
<tr>
<td>CSG mix</td>
<td>41.3</td>
</tr>
</tbody>
</table>
Bermudagrass

- High yield potential
- Fair to good persistence depending on cultivar
- Most forage types sprigged
- Good tolerance to:
  - heat stress
- Fair tolerance to:
  - drought
  - poor soil fertility
  - poor drainage
  - cold temperatures
- Forage quality good if managed but refusal an issue at times
Caucasian Bluestem

- Medium yield potential
- Good persistence
- Good tolerance to:
  - heat stress
  - drought
  - poor soil fertility
  - cold temperatures
- Poor tolerance to:
  - poor drainage
- Forage quality good if grazed hard and often. Lousy forage quality if allowed to mature.
- Difficult to interseed a winter crop into these stands.
**Crabgrass**

- Medium yield potential
- Good persistence if reseeding is managed properly
- Good tolerance to:
  - heat stress
  - poor drainage
  - poor soil fertility
- Fair tolerance to:
  - drought
- Forage quality good. Probably the easiest to manage for dairy quality feed.
### Monthly Forage Balance

<table>
<thead>
<tr>
<th></th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bermudagrass</td>
<td>0</td>
<td>0</td>
<td>108</td>
<td>150</td>
<td>162</td>
<td>120</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>Forage Needed by Herd</td>
<td>49</td>
<td>54</td>
<td>67</td>
<td>70</td>
<td>67</td>
<td>63</td>
<td>61</td>
<td>58</td>
</tr>
<tr>
<td>Forage Surplus/Deficit</td>
<td>-49</td>
<td>-54</td>
<td>41</td>
<td>80</td>
<td>95</td>
<td>57</td>
<td>-1</td>
<td>-58</td>
</tr>
</tbody>
</table>

- Bermudagrass – 6.0 t/a
- Stocking rate: 100 milking cows on 100 acres
- 15 Feb calving
- 10 lb grain/day
- 13,000 lb annual milk

Forage balance = 111 tons
Excess to be harvested = 273 tons
Excess to be fed back = 162 tons
Crabgrass Only

<table>
<thead>
<tr>
<th>Monthly Forage Balance</th>
<th>Mar</th>
<th>Apr</th>
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<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crabgrass</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>116</td>
<td>128</td>
<td>100</td>
<td>56</td>
<td>0</td>
</tr>
<tr>
<td>Forage Needed by Herd</td>
<td>49</td>
<td>54</td>
<td>67</td>
<td>70</td>
<td>67</td>
<td>63</td>
<td>61</td>
<td>58</td>
</tr>
<tr>
<td>Forage Surplus/Deficit</td>
<td>-49</td>
<td>-54</td>
<td>-67</td>
<td>46</td>
<td>61</td>
<td>37</td>
<td>-5</td>
<td>-58</td>
</tr>
</tbody>
</table>

- Crabgrass – 4.0 t/a
- Stocking rate: 100 milking cows on 100 acres
- 15 Feb calving
- 10 lb grain/day
- 13,000 lb annual milk

Forage balance = -89 tons
Excess to be harvested = 144 tons
Excess to be fed back = 233 tons
A Simple System

Forage Yield

Feb  Apr  Jun  Aug  Oct  Dec

Tall Fescue  Clover  Crabgrass  Cereal Rye
### Monthly Forage Balance

<table>
<thead>
<tr>
<th></th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
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<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tall Fescue/clover</td>
<td>4</td>
<td>39</td>
<td>83</td>
<td>57</td>
<td>31</td>
<td>6</td>
<td>34</td>
<td>38</td>
</tr>
<tr>
<td>Crabgrass - Cereal rye</td>
<td>51</td>
<td>45</td>
<td>0</td>
<td>45</td>
<td>66</td>
<td>54</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Forage Needed by Herd</td>
<td>49</td>
<td>54</td>
<td>67</td>
<td>70</td>
<td>67</td>
<td>63</td>
<td>61</td>
<td>58</td>
</tr>
<tr>
<td>Forage Surplus/Deficit</td>
<td>6</td>
<td>30</td>
<td>16</td>
<td>32</td>
<td>30</td>
<td>-3</td>
<td>-12</td>
<td>-6</td>
</tr>
</tbody>
</table>

- Tall fescue/clover – 50 acres – 6.0 t/a
- Crabgrass interseeded with rye in fall – 6.0 t/a
- Stocking rate: 100 milking cows on 100 acres
- 15 Feb calving
- 10 lb grain/day
- 13,000 lb annual milk

Forage balance = 93 tons
Excess to be harvested = 114 tons
Excess to be fed back = 21 tons
Monitor Pasture Growth

http://agebb.missouri.edu/dairy/grazing/wedge/index.htm
Monitor Pasture Growth

• Look at the entire system weekly
  - Does pasture growth meet your expectations?
    • Some folks even measure it.
  - How do current weather forecasts alter growth for the next week to two weeks?
  - How has your system responded historically at this time of year?
Key Factors for Managing Forage Systems

- Understand what nutrients your cows need and when they need them
  - Calving season of most importance
- Select forages that fit your climate, soils, calving season
  - Prepare a pasture growth budget
  - Develop plans for forage growth deficits and excesses
  - Monitor production frequently
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