Seven Habits for Highly Productive Pastures

Rhonda R. Gildersleeve
Associate Professor & Extension Grazing Specialist
Ag & Natural Resources Program Area
Office: UW Lancaster Ag Research Station
7396 State Hwy 35 & 81
Lancaster, WI 53813
rhonda.gildersleeve@ces.uwex.edu  (608) 723-6243
http://fyi.uwex.edu/grazres

Seven Habits:

• Match pasture management goals with herd needs
• Optimize soil fertility
• Go for legumes
• Add diversity to pasture/forage systems
• Manage your grazing system
• Fill seasonal forage gaps
• $how me the money!
Habit 1: Pasture Budgeting Goals

- What production do you need from your pastures?
- When do you expect to get it (seasonal aspects)?
- How do you plan to deal with forage deficits?
- How do you plan to deal with surplus forage production?

- UW Extension Pasture Budgeting Spreadsheet:
  http://www.uwex.edu/ces/forage/pubs/PASTURE_NEEDS.XLS

Run the numbers to prevent overstocking and assist with budgeting your forage resources

Habit 1: Match Pasture Management Goals with Herd Nutrient Demands

Beef Cow Production Cycle (365 days) Dunbar & George, 1986.

<table>
<thead>
<tr>
<th>Stage/days</th>
<th>Demand Level</th>
<th>Nutrient Demands for:</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 2 (0 – 90 days)</td>
<td>Very High</td>
<td>Calving; early lactation; estrus/breeding; growth (heifers)</td>
<td>BCS 5-6 at calving; cycles and breeds within 90 days</td>
</tr>
<tr>
<td>3 (90 – 180 days)</td>
<td>Moderate</td>
<td>Lactation; 1st trimester fetus; growth (heifers)</td>
<td>Maintain milk supply for calf; begin to replace body condition lost in Stage 1</td>
</tr>
<tr>
<td>4 (180 – 270 days)</td>
<td>Low</td>
<td>Late lactation; weaning; 2nd trimester fetus; growth (heifers)</td>
<td>Improve BCS to 5-6; utilize least cost feeds/forages</td>
</tr>
<tr>
<td>5 (270 – 365 days)</td>
<td>Moderately High</td>
<td>Dry, but preparing for next lactation; 3rd trimester fetus undergoes rapid growth; growth (heifers)</td>
<td>At least BCS 5-6 at calving; calve as close to 365 days as possible</td>
</tr>
</tbody>
</table>
**Beef Cow TDN Requirements: Spring Calving Scenario**

<table>
<thead>
<tr>
<th>Month</th>
<th>TDN, lbs. per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20</td>
</tr>
<tr>
<td>M</td>
<td>15</td>
</tr>
<tr>
<td>J</td>
<td>10</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>S</td>
<td>0</td>
</tr>
<tr>
<td>O</td>
<td>5</td>
</tr>
<tr>
<td>N</td>
<td>10</td>
</tr>
<tr>
<td>D</td>
<td>15</td>
</tr>
<tr>
<td>J</td>
<td>20</td>
</tr>
<tr>
<td>F</td>
<td>25</td>
</tr>
<tr>
<td>M</td>
<td>0</td>
</tr>
</tbody>
</table>

- **Cow, 20 lbs milk**
- **Cow, 30 lbs milk**
- **2 yr old Heifer**
- **Bred Heifer**
- **Pasture**

**Opportunities:** most closely matches pasture forage resource production, so least cost alternative for feeding lactating cows, use lower quality forages/crop residues for part of winter feeding period

**Challenges:** market disadvantage (?) if selling feeder calves, cull cows in fall months

---

**Opportunities:** Harvest excess pasture as quality forage, graze feeders; realize market premiums for feeders, cull cows; cows/calves utilize stockpiled forages, crop residues, fall annuals

**Challenges:** Early winter feeding period requires quality forage supplies, supplementation, feeding/facilities investments(?)
Habit 2: Optimize Soil Fertility

- Soil test pastures every 3 to 4 years
- Know your legume percentages:
  - < 30%, fertilize as a grass pasture
  - > 30%, fertilize as a legume pasture
- pH: 6.0 + for grasses; 6.3 – 6.5 for legumes
- Potassium and Phosphorus: maintain at optimum as recommended by soil tests, example (Wisconsin):
  - Phosphorus: 15+ ppm as measured by Bray P$_1$
  - Potassium: 120+ ppm
- Trace minerals as needed: sulfur, boron are especially important for legume growth

Optimize Soil Fertility…

Nitrogen:
- If > 30% legumes, no additional N is recommended
- Grasses are most responsive to first 40 – 60 lbs per acre
- Use split applications to stage production, example of recommended rates (Iowa State):

<table>
<thead>
<tr>
<th>Dominant Grasses:</th>
<th>Responsive Seasonal N, lbs/acre</th>
<th>Early Spring (March - April)</th>
<th>Late Spring (May - June) Optional</th>
<th>Late Summer (Aug - Sept) Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kentucky bluegrass</td>
<td>150</td>
<td>60 – 80</td>
<td>30 – 40</td>
<td>30 – 40</td>
</tr>
<tr>
<td>Orchardgrass, tall fescue, bromegrass, etc.</td>
<td>240</td>
<td>80 - 120</td>
<td>40 – 60</td>
<td>40 – 60</td>
</tr>
</tbody>
</table>
Habit 3: Go for Legumes

Legumes have important roles in pasture systems:
• Source of high quality feed
• Nitrogen fixation capacity
• Help “smooth out” seasonal pasture production curves
• Species diversity

And...legumes can be a challenge to establish and maintain in pasture systems!

Legume Nitrogen Contributions

Nitrogen fixation ranges of legumes grown in Upper Midwest and the rhizobial strain needed for effective nodulation.

<table>
<thead>
<tr>
<th>Legume</th>
<th>N fixed, lbs/A/yr</th>
<th>Rhizobial Strain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>80 – 190</td>
<td>Alfalfa group: Rhizobium meliloti</td>
</tr>
<tr>
<td>Sweet clover</td>
<td>80 – 120</td>
<td>Clover group: Rhizobium trifolii</td>
</tr>
<tr>
<td>Alsike, red, white clovers</td>
<td>65 - 150</td>
<td>Species specific: Rhizobium loti</td>
</tr>
<tr>
<td>Birdsfoot trefoil</td>
<td>44 - 150</td>
<td>Species specific: Rhizobium ambiguum</td>
</tr>
<tr>
<td>Crown vetch</td>
<td>50 - 100</td>
<td>Species specific: Rhizobium varia</td>
</tr>
<tr>
<td>Kura clover</td>
<td>65 - 150</td>
<td>Species specific: Rhizobium incbens</td>
</tr>
<tr>
<td>Lupine</td>
<td>50 - 150</td>
<td>Species specific: Rhizobium lupini</td>
</tr>
<tr>
<td>Field &amp; Austrian Winter Peas Hairy &amp; Common Vetches</td>
<td>50 - 150</td>
<td>Pea &amp; Vetch group: Rhizobium leguminosarum</td>
</tr>
</tbody>
</table>

• Nitrogen available to grasses = 1/3 – 1/2 of N fixed (50 – 80 lbs/year)
• Legumes fix more N in mixtures with grasses
• Use the right rhizobial strain for the legume species!!

Rhizobium nodule on soybean (photo by Jennifer Dean)

Kura clover
### Legumes Contribute Production and Quality

**Holstein stockers**  
1998-2000, Lancaster

<table>
<thead>
<tr>
<th>Treatment</th>
<th>ADG, lbs/day</th>
<th>Gain/acre, lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kura clover + grass</td>
<td>2.66</td>
<td>909</td>
</tr>
<tr>
<td>Red clover + grass</td>
<td>2.18&quot;</td>
<td>713&quot;</td>
</tr>
</tbody>
</table>

**Crossbred beef stockers**  
2010-2011, Arlington

<table>
<thead>
<tr>
<th>Treatment</th>
<th>ADG, lbs/day</th>
<th>Gain/acre, lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tall Fescue + N</td>
<td>1.55</td>
<td>648b</td>
</tr>
<tr>
<td>Tall Fescue + Clover</td>
<td>2.02</td>
<td>740a</td>
</tr>
<tr>
<td>Meadow Fescue + N</td>
<td>1.86</td>
<td>628b</td>
</tr>
<tr>
<td>Meadow Fescue + Clover</td>
<td>2.24</td>
<td>779a</td>
</tr>
<tr>
<td>SEM</td>
<td>0.04</td>
<td>26</td>
</tr>
</tbody>
</table>

**Choosing Legumes**

**Considerations:**
- Yield
- Compatibility with dominant grass species
- Grazing tolerance
- Persistence
- Production system needs (grazing, forage, both?)
Habit 4: Increase Pasture Diversity

- **Diversity**: having several species of forage plants well represented in a pasture

- **Two strategies:**
  - Diversity within pastures
  - Farm diversity: mixtures may differ between pastures

- **Desired outcomes:**
  - More consistency in seasonal production, pasture quality
  - Increase management flexibility of grazing system
  - Dense swards
  - Fewer weeds

---

Habit 4: Increase Pasture Diversity

- **Goal**: at least two **functional groups** represented by 3 – 4 compatible species:
  - Cool season grasses
  - Warm season grasses
  - Legumes
  - Palatable forbs (examples: chicory, dandelions, etc.)
  - Annuals

- **Compatibility criteria to consider:**
  - Adapted to site conditions (fertility, drainage, etc.)
  - Growth habits
  - Grazing tolerance
  - Winter hardiness
  - Palatability
  - Seedling vigor/ease of establishment
  - Mechanical harvest suitability
Example:
Grazing Tolerance

**Excellent:**
- Kentucky bluegrass
- Ryegrasses
- Kura clover
- White clover

**Fair:**
- Meadow bromegrass
- Smooth bromegrass
- Timothy

**Good:**
- Festulolium
- Meadow fescue
- Orchardgrass
- Reed canarygrass
- Tall fescue
- Alfalfa
- Birdsfoot trefoil
- Red clover
- Alsike clover

---

**Intake**
**Rest**
**Residuals**
**Rotation**

**Habit 5: Manage Your Grazing System**
Rotational Grazing Considerations

When is the paddock “ready” to be grazed?

• Enough forage is available to satisfy animals’ dry matter intake needs for grazing period
• Plant is physiologically capable of regrowth after defoliation

<table>
<thead>
<tr>
<th>Plant Height (inches)</th>
<th>Grass Species</th>
<th>Spring</th>
<th>Summer/Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Orchardgrass, smooth bromegrass, tall fescue, timothy, reed canarygrass</td>
<td>10 - 12</td>
<td>10 +</td>
</tr>
<tr>
<td></td>
<td>Perennial ryegrass, Kentucky bluegrass</td>
<td>6</td>
<td>6 +</td>
</tr>
</tbody>
</table>

Rotational Grazing Considerations

How long to graze?

• Ensure that animals uniformly graze pastures without re-grazing individual plants, usually 12 to 72 hours (1/2 to 3 days)
• Remove animals when plant residue target heights are met

Set up grazing system for flexible paddock size and/or vary animal numbers to increase harvest efficiency with more uniform grazing.

Aim for 1 bite per plant per grazing event.
Harvest Efficiency: Match amount of pasture offered to daily animal dry matter intake needs

<table>
<thead>
<tr>
<th>Number of Paddocks</th>
<th>Grazing Period</th>
<th>Paddock Rest, %</th>
<th>Utilization Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Continuous</td>
<td>0</td>
<td>30%</td>
</tr>
<tr>
<td>4</td>
<td>7 – 10 days</td>
<td>75</td>
<td>35%</td>
</tr>
<tr>
<td>8</td>
<td>3 – 5 days</td>
<td>86</td>
<td>50%</td>
</tr>
<tr>
<td>12</td>
<td>2 – 4 days</td>
<td>91</td>
<td>65%</td>
</tr>
<tr>
<td>28</td>
<td>1 day</td>
<td>96</td>
<td>70+%</td>
</tr>
</tbody>
</table>

Long grazing periods decrease pasture harvest efficiency!!

Rotational Grazing Considerations

How Long to Rest?
- Length of rest needed changes seasonally and in response to weather conditions: Increase rest when growth slows
- Plants must rest to replace stored energy reserves and grazed leaf area
- Forage species’ also vary in days of rest needed:

<table>
<thead>
<tr>
<th>Category</th>
<th>Cool Weather (days)</th>
<th>Hot Weather (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool season grasses</td>
<td>14 - 21</td>
<td>35 – 50</td>
</tr>
<tr>
<td>Warm season grasses</td>
<td>35 – 40</td>
<td>21</td>
</tr>
<tr>
<td>Legumes*</td>
<td>21 – 28</td>
<td>21 - 28</td>
</tr>
</tbody>
</table>
Residual Forage

...the amount of forage remaining after grazing...

- Impacts leaf area
  - Need to retain a high proportion of green leaves in residual canopy for efficient growth rates
  - Optimum residual differs by species
  - Rule of thumb: Remove ≤ 50% of leaf area

- Impacts animal intake
  - Bite size becomes limited with low pasture residuals: intake declines and animal production will be limited
  - Use residual forage as your guide that livestock are ready to move on to fresh feed

Residual Height:
Effects on Future Growth

<table>
<thead>
<tr>
<th>Residual height, inches</th>
<th># Grazing Events during season</th>
<th>Ave. rotation period, days</th>
<th>Ave. yield per rotation</th>
<th>Annual yield</th>
<th>1st Grazing Date, following year</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>6</td>
<td>24</td>
<td>750</td>
<td>4500</td>
<td>April 28</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>32</td>
<td>900</td>
<td>5400</td>
<td>May 4</td>
</tr>
<tr>
<td>1.5</td>
<td>4</td>
<td>44</td>
<td>1250</td>
<td>5000</td>
<td>May 11</td>
</tr>
</tbody>
</table>

Data courtesy of Geoff Brink, US Dairy Forage Research Center; grasses used in the study were: meadow fescue, orchardgrass, quackgrass and reed canarygrass
Rest and Residuals: Bottom Line

- Pasture swards can regrow more quickly after defoliation without depleting root reserves
- Other benefits from observing rest and residual targets:
  - Less runoff, better moisture conservation
  - Fewer weed problems
  - Higher soil organic matter
  - Buffers soil temperatures
  - Wildlife habitat benefits

Habit 6: Fill Seasonal Production Gaps

How can we address these seasonal gaps in pasture production?

“Average” grazing season: May 1 – October 15 = 168 days

<table>
<thead>
<tr>
<th>J</th>
<th>F</th>
<th>M</th>
<th>A</th>
<th>M</th>
<th>J</th>
<th>J</th>
<th>A</th>
<th>S</th>
<th>O</th>
<th>N</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Early Spring 15 – 30 days?
Summer Slump ~ 45 days?
Late Fall/ Early Winter ~ 60 + days?
Habit 6: Fill Seasonal Production Gaps

“Average” grazing season: May 1 – October 15 = 168 days

<table>
<thead>
<tr>
<th></th>
<th>J</th>
<th>F</th>
<th>M</th>
<th>A</th>
<th>M</th>
<th>J</th>
<th>J</th>
<th>A</th>
<th>S</th>
<th>O</th>
<th>N</th>
<th>D</th>
</tr>
</thead>
</table>

Challenges:
weather, slow early growth

Early Spring Forage Gap:

• A most challenging gap to fill!
  - Limited options
• Winter wheat or rye: sown the fall before, graze very early, then pull off for forage or grain production later in the spring
• Spring-seeded oats, Italian ryegrass—come on a little later, but may fill a gap as an emergency option if renovation or rest is needed for other pastures/forages
Habit 6: Fill Seasonal Production Gaps

“Average” grazing season: May 1 – October 15 = 168 days

Challenges:
- heat, drought, dry matter intake

Average grazing season: May 1 – October 15 = 168 days

Summer Slump Options:

- Summer slump: period of slow growth due to hot and possibly dry weather conditions, usually mid-July to mid-August

“Speciality” options for summer gap: warm season perennials, sorghum-sudangrass, teff, corn, etc.

Permanent pastures: delay grazing on some pastures until later in the season:
- Outwintered areas reseeded and rested through the early months of the grazing season
- Hayfields grazed after winter feed needs are met
- Pasture forages that handle summer conditions: reed canarygrass, alfalfa, tall fescue
Habit 6: Fill Seasonal Production Gaps

“Average” grazing season:
May 1 – October 15 = 168 days

Challenges:
Earlier growing conditions, growth rates, seasonal production limited

Grazing Dormant Hayfields

- Allow growth to accumulate in hayfields at least 6 weeks before first killing frost
- Use strip grazing
- Avoid use during wet weather periods
- Legumes: use before stockpiled cool season grass pastures
**Fall Annual Forages**

- Primarily small grains and Brassica spp. (turnips, kale, etc.)
- Mixtures offer flexibility
- Dual purpose: grazing, harvested forage needs
- High forage quality, more like a concentrate, use as a supplemental forage to “stretch” other pastures
- 1 – 4 tons/acre DM yields
- Utilize in fall through early winter
- Use for crop rotation pastures or no-tilled into a light sod
- Good fertility, nitrogen or legume/manure credits needed
- Strip grazing system, ½ day grazing common

---

**Stockpiled Forages: Fall & Winter**

- Forage is accumulated on pasture in late summer and grazed after the growing season ends
- Rest some pastures for late-season use beginning in early August (southern WI)
- Apply 40 – 60 lbs. N to stimulate grass growth if needed
- CP may be 15 - 20% +
- High percentage of forage material is LEAVES
- .75 - 1.5 tons per acre yields
Use timothy, smooth bromegrass, quackgrass in fall and late maturing orchardgrass varieties by December

Use tall fescue, early-maturing orchardgrass, and reed canarygrass for grazing through late fall and winter

Managing Stockpiled Forages

• Plan on 20 – 30% of forage needs for fall stockpiling period
• Allocate in 1 – 3 day feed supply intervals:
  – Maintains forage utilization efficiency
  – Decreases unnecessary trampling/waste of standing forage
  – Prevents excess damage if conditions are wet
  – Distributes manure
  – Use harvested forages as a supplement to stretch stockpiled pastures
Corn Stalk Residues:

- Usually worth 45 – 60+ days grazing
- Cattle consume 30 – 40% corn stalk residues (1800 – 3200 lbs/ac)
- Select most palatable & highest quality portions first
- Make a protein supplement available
- Strip or rotational grazing recommended

<table>
<thead>
<tr>
<th></th>
<th>Husk</th>
<th>Leaf</th>
<th>Plant stem a</th>
<th>Parts Cob</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of residue DM</td>
<td>12</td>
<td>27</td>
<td>49</td>
<td>12</td>
</tr>
<tr>
<td>Crude Protein, % DM</td>
<td>3.6</td>
<td>7.8</td>
<td>4.5</td>
<td>2.2</td>
</tr>
<tr>
<td>IVDMD, %</td>
<td>67</td>
<td>47</td>
<td>45</td>
<td>35</td>
</tr>
<tr>
<td>Palatability</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

a includes leaf sheath


Habit 7: $how Me the Money!

We know that pasture can be our lowest cost feed resources, but how much is it really worth???

Assumption: each beef cow gets of 25 lbs. forage dry matter per day from pasture, savings are per cow in herd

<table>
<thead>
<tr>
<th>Days grazed</th>
<th>SAVINGS, purchased hay equivalent, price per ton</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$125</td>
</tr>
<tr>
<td>60</td>
<td>94</td>
</tr>
<tr>
<td>90</td>
<td>141</td>
</tr>
<tr>
<td>120</td>
<td>188</td>
</tr>
<tr>
<td>150</td>
<td>234</td>
</tr>
<tr>
<td>180</td>
<td>282</td>
</tr>
<tr>
<td>210</td>
<td>328</td>
</tr>
<tr>
<td>240</td>
<td>375</td>
</tr>
</tbody>
</table>
### WI Production Costs per Cow for MiG and non-MiG Beef Farms

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>MiG Beef Farms</th>
<th>Non-MiG Beef Farms</th>
<th>Percent MiG: Non-MiG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hired labor</td>
<td>$258</td>
<td>$352</td>
<td>0.73</td>
</tr>
<tr>
<td>Feed cost</td>
<td>$144</td>
<td>$193</td>
<td>0.75</td>
</tr>
<tr>
<td>Equipment rent</td>
<td>$75</td>
<td>$118</td>
<td>0.64</td>
</tr>
<tr>
<td>Chemical cost</td>
<td>$78</td>
<td>$98</td>
<td>0.80</td>
</tr>
<tr>
<td>Land &amp; facilities rent</td>
<td>$190</td>
<td>$231</td>
<td>0.82</td>
</tr>
<tr>
<td>Depreciation</td>
<td>$207</td>
<td>$264</td>
<td>0.78</td>
</tr>
<tr>
<td>Fuel cost</td>
<td>$73</td>
<td>$88</td>
<td>0.83</td>
</tr>
<tr>
<td>Repairs cost</td>
<td>$110</td>
<td>$130</td>
<td>0.85</td>
</tr>
<tr>
<td>Fertilizer cost</td>
<td>$130</td>
<td>$171</td>
<td>0.76</td>
</tr>
<tr>
<td>Utilities cost</td>
<td>$40</td>
<td>$51</td>
<td>0.78</td>
</tr>
<tr>
<td>Total</td>
<td>$1359</td>
<td>$1776</td>
<td>0.77</td>
</tr>
</tbody>
</table>

*COSTS reduced by > 15% in EVERY CATEGORY!!

Source: 2007 US Ag Census

### Questions???