Species Considerations for Pasture and Hay

Forage Selection Considerations

- Climate (Winter hardiness, drought, etc.)
- Soil type and texture (adaptation to drainage)
- Length of stand (short rotation, long rotation, permanent)
- Type of harvest (pasture, hay, silage, mixed)
- Desired forage quality and animal needs
- Specific animal/forage problems
- Disease/insect pest potential
- Seed cost and ease of establishment
- Forage Use (on-farm or marketed)
Forage Selection Considerations

Winter Hardiness

Most Hardy
- Reed canarygrass
- Timothy
- Tall fescue
- Smooth bromegrass
- Orchardgrass
- Perennial ryegrass
- Festulolium

Least Hardy

Winter hardness is very cultivar dependent for grasses and legumes

Winter hardiness is very cultivar dependent for grasses and legumes
Soil Drainage

<table>
<thead>
<tr>
<th>Species</th>
<th>Dry</th>
<th>Medium</th>
<th>Wet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red clover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birdsfoot trefoil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White clover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orchardgrass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reed canarygrass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smooth bromegrass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tall fescue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timothy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perennial ryegrass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kentucky bluegrass</td>
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</tr>
</tbody>
</table>

Choose the right forage species...

Forage Selection Considerations

- Climate (Winter hardiness, drought, etc)
- Soil type and texture (adaptation to drainage)
- Length of stand (short rotation, long rotation, permanent)
### Forage Selection Considerations

- Climate (Winter hardiness, drought, etc)
- Soil type and texture (adaptation to drainage)
- Length of stand (short rotation, long rotation, permanent)
- Type of harvest
  - Haylage only
  - Hay/haylage combination
  - Pasture only
  - Mixed pasture and hay
  - Deferred grazing (stockpile)

### Plant Height Classification

#### Tall Species
- Alfalfa
- Red clover
- Upright varieties of birdsfoot trefoil
- Alsike clover
- Timothy
- Smooth bromegrass
- Orchardgrass
- Tall fescue
- Reed canarygrass

#### Intermediate Species
- Intermediate varieties of birdsfoot trefoil
- Ladino type of white clover
- Perennial ryegrass

#### Short Species
- 'Empire' type varieties of birdsfoot trefoil
- Common and Dutch varieties of white clover
- Kentucky bluegrass

### Most Adapted Species for Pasture
- All types of white clover
- Red clover
- Intermediate or short varieties of birdsfoot trefoil
- Alsike clover
- Kentucky bluegrass
- Orchardgrass
- Tall fescue**
- Perennial ryegrass
- Italian ryegrass
- Festulolium
- Reed canarygrass

### Less Adapted Species for Pasture*
- Alfalfa
- Upright varieties of birdsfoot trefoil
- Timothy
- Smooth bromegrass
- Requires careful management

** Palatability issues makes tall fescue undesirable in pasture mixtures for dairy particularly
Forage Selection Considerations

- Climate (Winter hardiness, drought, etc)
- Soil type and texture (adaptation to drainage)
- Length of stand (short rotation, long rotation, permanent)
- Type of harvest (pasture, hay, silage, mixed)
- Desired forage quality and animal needs
  - Tolerance of intensive management
  - Time of reproductive maturity
  - Fiber digestibility
  - Palatability

(Cultivars can make as much a difference as species)

Plant Response to Defoliation Intensity

- Intolerant of early first cut:
  - Smooth bromegrass
- Less tolerant of early first cut
  - Timothy (variety dependent)
- Tolerant of early first harvest:
  - Orchardgrass
  - Reed canarygrass
  - Tall fescue/meadow fescue
  - Perennial ryegrass

Relative Heading Date

<table>
<thead>
<tr>
<th>Species</th>
<th>Relative Maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early</td>
</tr>
<tr>
<td>Orchardgrass</td>
<td></td>
</tr>
<tr>
<td>Early varieties</td>
<td>[     ]</td>
</tr>
<tr>
<td>Late varieties</td>
<td>[     ]</td>
</tr>
<tr>
<td>Perennial Ryegrass</td>
<td></td>
</tr>
<tr>
<td>Early varieties</td>
<td>[     ]</td>
</tr>
<tr>
<td>Late varieties</td>
<td>[     ]</td>
</tr>
<tr>
<td>Reed canarygrass</td>
<td></td>
</tr>
<tr>
<td>Early varieties</td>
<td>[     ]</td>
</tr>
<tr>
<td>Late varieties</td>
<td>[     ]</td>
</tr>
<tr>
<td>Smooth bromegrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[     ]</td>
</tr>
<tr>
<td>Tall fescue</td>
<td></td>
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<tr>
<td></td>
<td>[     ]</td>
</tr>
<tr>
<td>Timothy</td>
<td></td>
</tr>
<tr>
<td>Early varieties</td>
<td>[     ]</td>
</tr>
<tr>
<td>Late varieties</td>
<td>[     ]</td>
</tr>
</tbody>
</table>
Forage Selection Considerations

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- Specific animal/forage problems
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Mixtures and Blends

Mixture - two or more forage species grown together (often at least one legume and one grass)

Blend - two or more cultivars of a single specie

Brand – a trademark name of a mixture and/or blend
Advantages of Grass-Legume Mixtures

- Legumes usually provide adequate N to the stand if their proportion of the mix is over 30%

- Legumes increase protein concentrations in the mixture

Advantages of Grass-Legume Mixtures

- Legumes often extend grazing season into mid summer when cool season grasses slow down in growth

Advantages of Grass-Legume Mixtures

- Mixtures reduce risk of stand failure
  - Mixtures tolerate wider variability in soil conditions
  - The fibrous roots of grasses help to resist heaving often found with taprooted legumes
Advantages of Grass-Legume Mixtures

- Mixtures help to resist lodging

Advantages of Grass-Legume Mixtures

- Grasses improve drying rate when mixed with some legumes
- Mixtures ensile better than pure legume or pure grass stands

Advantages of Grass-Legume Mixtures

- Mixtures tend to reduced the risk of forage related animal disorders such as bloat, nitrate poisoning, grass tetany or mineral imbalances
Advantages of Grass-Legume Mixtures

<table>
<thead>
<tr>
<th>Animal Requirement</th>
<th>Plant Levels</th>
<th>Grasses</th>
<th>Legume</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>0.20 - 0.43</td>
<td>0.2 - 0.5</td>
<td>0.2 - 0.5</td>
</tr>
<tr>
<td>Ca</td>
<td>0.18 - 0.60</td>
<td>0.2 - 1.0</td>
<td>1.2 - 2.5</td>
</tr>
<tr>
<td>Mg</td>
<td>0.05 - 0.20</td>
<td>0.1 - 0.3</td>
<td>0.2 - 0.4</td>
</tr>
</tbody>
</table>

What Is The Objective For The Mixture

- Meet specific livestock production needs?
- Maximum production?
- Managing uncertainty or variability?
- Seasonal distribution?
- Long or short term persistence?

Formulating Mixtures

- Species adaptation to soil drainage
- Species compatibility (germination rate, relative maturity and growth rate, spreading pattern, etc.)
- Forage use
  - Pasture
  - Hay
  - Haylage
- Livestock needs
- Simple or complex mixtures?
- Follow the “KISS” rule
Evolution of pasture mixture complexity in 20th century

<table>
<thead>
<tr>
<th>Year</th>
<th>Species in Mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1888</td>
<td>13 grasses, 2 legumes</td>
</tr>
<tr>
<td>1945</td>
<td>4 grasses, 3 legumes</td>
</tr>
<tr>
<td>2010</td>
<td>Grass, legume</td>
</tr>
</tbody>
</table>

Composition of commercial mixtures

<table>
<thead>
<tr>
<th>Number of Species in Mixture</th>
<th>Percentage of All Mixtures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25%</td>
</tr>
<tr>
<td>2</td>
<td>15%</td>
</tr>
<tr>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>4 or more</td>
<td>30%</td>
</tr>
</tbody>
</table>

Source: Matt Sanderson

Formulating Mixtures

- What about using Commercial Brand Mixtures from my local seed dealer?
- Does it have what you need?
  - Species
  - Varieties
- Do they include certified, named cultivars or “common” cultivars?
- Mixtures may change from year to year
- Mixtures change among companies
### Composition of commercial mixtures

<table>
<thead>
<tr>
<th></th>
<th>Company A</th>
<th>Company B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perennial ryegrass</td>
<td>30%</td>
<td>9%</td>
</tr>
<tr>
<td>Orchardgrass</td>
<td>20%</td>
<td>13%</td>
</tr>
<tr>
<td>Tall fescue</td>
<td>20%</td>
<td>14%</td>
</tr>
<tr>
<td>Kentucky bluegrass</td>
<td>14%</td>
<td>12%</td>
</tr>
<tr>
<td>Red clover</td>
<td>12%</td>
<td>41%</td>
</tr>
<tr>
<td>White clover</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Alaska bromegrass</td>
<td>12%</td>
<td></td>
</tr>
<tr>
<td>Red clover</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White clover</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicory</td>
<td>2%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Matt Sanderson

### Evaluating Complex Mixtures

**Small Plot Site, Randolph, VT 2007 - 2010**
- 18 Commercial Mixtures
- 5 Festulolium cultivars with white clover
- 4 Orchardgrass cultivars with white clover
- 1 Alaska bromegrass with white clover
- Three replications

### Northeast SARE Study Results

25 to 30 commercial mixtures evaluated under grazing in Massachusetts, Pennsylvania, and Vermont

![Graph showing dry matter yield vs. number of species in mix]

- Total of 6 harvests 2008 (circles) and 2009 (solid)

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**Shotgun Mix or Targeted Diversity?**

(Targeted (Functional) Approach)

- Drought paddocks
- High quality paddocks
- Annual paddocks
- Medicinal paddocks?

- Wet weather paddocks
- Sacrifice areas
- Extended grazing paddocks
- Calving/Lambing paddocks

Source: Matt Sanderson

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**Targeted (Functional) Approach**

- Alfalfa Orchardgrass hay
- Alfalfa Orchardgrass Chicory pasture
- Reed canary trefoil pasture
- Dairy heifers
- Pastured poultry

Source: Matt Sanderson

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**What should I plant?**

New England Forage & Weed ID and Management Training Project

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Playing 20 questions...

- What are your goals?
- What is the site like?
- How are you going to use this?
- How do you harvest forages?
- What species are you feeding?
- What are your future plans?
- What equipment is available?
2014 Maine Corn Hybrid Performance Trial


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Choosing corn silage varieties

- Relative maturity (RM X 25 = GDD?)
- Yield (Compare on DM basis)
- Digestibility (NDFd---milk per ton---milk per acre) ---bmr variety?
- Disease resistance (Northern Corn Leaf Blight)
- Insecticidal traits (Bt)....do you really need them?
- GMO/non GMO corn ....will there be a new market for non-GMO corn?
**Why Consider Annuals**

- Drought tolerant—warm season annuals
- Cold tolerant (spring/fall annuals)
- Fill gaps in feed (Summer annuals)
- High biomass potential
- Fast growing competitive crops
- Risk management
- Rotation crop
- Multipurpose—flexibility
  - Grazing
  - Silage/balage
  - Grain/seed

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**Typical Summer Annuals**

- Sorghum
- Sudangrass
- Sorghum x Sudangrass
- Pearl Millet
- Japanese Millet
- Teff

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**Forage Sorghum**
- Thicker stems
- One cut systems (low regrowth potential)

**Sudangrass**
- Fine stems and leafier
  - Good regrowth potential

**Sorghum x Sudangrass**
- Thicker stems, leafy
  - Moderate regrowth potential

**BMR varieties with high digestibility**

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**Sorghums and Sorghum/Sudangrass management**

- Most forage Sorghums are harvested as a one cut alternative to corn silage and not utilized for grazing.
- Issues with Sorghums as grazing crop is the concentration of dhurrin which breaks down into prussic acid or HCN (Hydrogen Cyanide).
- Harvest for storage eliminates this issue through time and fermentation.
- Green chop can be a big prussic acid issue.
- Harvest forage sorghums at mid-dough stage.

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**Sudangrass...sorghumXsudangrass**

- Rotation
  - Take first and/or second cut.
  - 25th of June and 1st of July planting.
  - Grazed 3x (24-36 inches) // harvest 2X?
  - Leave residue through winter.
  - Reseed field in early spring.

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**Harvest issues**

- Harvest when 36-42 inches tall.
- Moisture removal can be a problem...cut high 6-8 inches.
- Wet fermentations with crops that remain in the field a long time increase the potential for clostridial fermentation.
- Advantages over corn...can be round baled and wrapped.
Millet
smaller stems and greater leaf biomass
regrowth potential good
no prussic acid
tolerates wetter and cooler soil conditions

Teff
small stems and leafy
tolerant many soils types
quick growth 9 to 12 weeks
best for hay

Feeding Millet

• Some millets do contain the BMR gene!
• Grazing 5-6 weeks after planting when 15-18 inches tall (optimum quality is 18-25 inches)
• Graze management so animals leave 6-8 inches of stubble
• Higher in CP than Sorghum Sudan Grass
  ...consider carbohydrate supplementation sources
• Grazing interval....3-4 weeks
• Consider staggering planting dates?

Millet Concerns...

• Millets may accumulate nitrates under higher N fertilization and under stress (drought) conditions as well as after frosts (4 day rule)
• Nitrates accumulate in lower portion of stalk, so residual management is important
• Strip graze to limit waste from trampling and defecation refusal...use back fence!
• One cut silage harvest...at boot to soft dough stage...wilting may be a problem
• Good reference on Nitrate toxicity...http://www.ext.colostate.edu/pubs/livestk/01610.html
Cool Season Annuals

- Small grains for winter cover crops
  - Winter Triticale/winter rye/spelt/oats (not winter hardy)
  - Graze/harvest in fall (forage oats)
  - Early feed in spring?
  - Worse case scenario green manure/cover/nutrient capture
- Reasonable dry matter yield for early feed in May
- Potential for good quality feed
- Cows like to graze very palatable

Spring and Winter Cereal Crops

- Oats & Triticale in late summer (middle of August)
- Same as planting triticale – higher seeding rate 150 lbs/acre
- Planting two crops one for fall and one for spring grazing
- High quality and palatable – of all annuals cows milk best on oats
  - Same rotation – graze triticale in spring and reseed

Other Season Extension ideas to plan for....

- Winter grains sown in late August for fall and spring grazing...undersow for new forage establishment
- Brassicas sown in August for late fall/winter grazing (with winter grain)
- “Tillage” Radish sown in late July can help extend the season and provide compaction relief.
Fall Seeded Brassica

- Seeded in mid-August
- 5 lbs per acre seeding rate
- Mid-September 10 inches in height
- Harvested in mid-October
- Potential for multiple harvest times
- At harvest 2 to 3 feet in height
- Consider seeding with winter annual grain or forage oats

Species Selection/Mixture Composition

**Take home messages:**
- Define your objective or goal
- Consider soil, landscape, other resources
  - What fits?
  - Simple mix may be best on highly productive site
- Consider species adaptation, compatibility, aggressiveness
- Think about separate plantings
  - Targeting diversity
  - Potentially simplify management
- Keep grazing animal behavior in mind

Questions