SARE PDP Webinar: Considerations When Choosing Forage and Pasture Plants

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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

New England Forage and Weed ID and Management Training Project

Forage and Pasture Species Description and Selection

The following are materials and some links about the description and selection of our major forages used in the Northeast. If you have additional materials, favorite websites or presentations that you have made pertaining to this, please send them to me and I’ll post them.

Factsheets, Bulletins and Articles

Species Description and Selection
Growing Forage Grasses in Maine (U. of Maine)
Growing Forage Legumes in Maine (U. of Maine)
Selecting Forage Crops for Your Farm (U. of Maine)
Pasture Production with Selected Forage Species (UNH)
Description and Seeding Rates for Forage Plants (U. of Vermont)
Characteristics of Forage and Pasture Species in Vermont (U. of Vermont)
Red Clover (Un of Wis.)
Birdsfoot Trefoil (Un. of Minn.)
Reed Canarygrass (Un. of Minn.)
Forage Fescues in the Northern U.S. (Un. of Wis.)

Perennial Forage Variety Information
Penn State Forage Variety Trial Reports
Cornell Forage Variety Trial Reports
Wisconsin Forage Variety Trial Reports
Michigan State Forage Variety Trial Reports
Ontario Forage Variety Trial Reports
New Brunswick Forage and Crop Evaluations
Forage Selection Considerations

Characteristics of Forage and Pasture Species Grown In Vermont

<table>
<thead>
<tr>
<th>Species</th>
<th>Soil Moisture Adaptation</th>
<th>Soil Fertility Adaptation</th>
<th>Drought Tolerance</th>
<th>Periods Of Production</th>
<th>Relative Maturity</th>
<th>Growth Habit</th>
<th>Height Classification</th>
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<tbody>
<tr>
<td>Kentucky Bluegrass</td>
<td>Well-drained to moist</td>
<td>Good to medium</td>
<td>Poor</td>
<td>Early spring and late fall</td>
<td>Early</td>
<td>Dense sod-rhizomatous</td>
<td>Short</td>
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<tr>
<td>Timothy</td>
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<td>Medium to fair</td>
<td>Poor</td>
<td>Late spring and fall</td>
<td>Medium-late to late</td>
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<tr>
<td>Smooth Bromegrass</td>
<td>Well-drained</td>
<td>High to good</td>
<td>Good</td>
<td>Spring, summer and fall</td>
<td>Medium-late</td>
<td>Open sod-rhizomatous</td>
<td>Tall</td>
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<td>Orchardgrass</td>
<td>Droughty to moist</td>
<td>Medium to fair</td>
<td>Good</td>
<td>Early spring, summer and fall</td>
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<td>Reed Canarygrass</td>
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<td>Very good</td>
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<td>Tall Fescue</td>
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<td>Good</td>
<td>Early spring, summer and fall</td>
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<td>Bunch</td>
<td>Tall</td>
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<td>Perennial Ryegrass</td>
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<td>Poor</td>
<td>Early spring and late fall</td>
<td>Early to medium</td>
<td>Bunch</td>
<td>Short to medium</td>
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<td>Festuolium</td>
<td>Well-drained to moist</td>
<td>Good to medium</td>
<td>Poor</td>
<td>Early spring and late fall</td>
<td>Early</td>
<td>Bunch</td>
<td>Medium</td>
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1 Maturity classification refers to the relative time of heading and depends not only on species but also on variety.
2 There is a wide maturity range amongst varieties for timothy, orchardgrass and perennial ryegrass.
3 The growth habit of tall fescue is primarily as a bunchgrass but some varieties can produce short rhizomes under intense cutting or grazing management.
4 Best adapted to locations with mild winters or where snow cover is reliable, promoting longer stand life.
Winter Hardiness

Winter hardiness is very cultivar dependent for grasses and legumes.

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

Least Hardy
<table>
<thead>
<tr>
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<td></td>
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<tr>
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<tr>
<td>Birdsfoot trefoil</td>
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<td>White clover</td>
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</tr>
<tr>
<td>Orchardgrass</td>
<td></td>
</tr>
<tr>
<td>Reed canarygrass</td>
<td></td>
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<tr>
<td>Smooth bromegrass</td>
<td></td>
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<tr>
<td>Tall fescue</td>
<td></td>
</tr>
<tr>
<td>Timothy</td>
<td></td>
</tr>
<tr>
<td>Perennial ryegrass</td>
<td></td>
</tr>
<tr>
<td>Kentucky bluegrass</td>
<td></td>
</tr>
</tbody>
</table>
Choose the right forage species...

Figure 1. Orchardgrass yield potential on 640 NY soil types. Drainage classes are exceptionally well drained (E) to very poorly drained (V).

Cherney, 2011, Cornell University
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

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### 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
<table>
<thead>
<tr>
<th>Species</th>
<th>Relative Maturity</th>
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<tr>
<td></td>
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<td>Early varieties</td>
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<td>Late varieties</td>
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<tr>
<td>Reed canarygrass</td>
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<td>Timothy</td>
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<tr>
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<td></td>
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Forage Selection Considerations

What’s the best pasture or haycrop mixture?
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>
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<tbody>
<tr>
<td>-%dm -</td>
<td>- - %dm -</td>
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<tr>
<td>P</td>
<td>0.20 - 0.43</td>
<td>0.2 - 0.5</td>
<td>0.2 - 0.5</td>
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<tr>
<td>Ca</td>
<td>0.18 - 0.60</td>
<td>0.2 - 1.0</td>
<td>1.2 - 2.5</td>
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<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>

New England Forage & Weed ID and Management Training Project
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?

New England Forage & Weed ID and Management Training Project
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

Number of species in pasture mixture

13 grasses, 2 legumes

4 grasses, 3 legumes

Grass, legume

1888 C.L. Flint

1945 USDA Mixture

2010 Current recommendations

New England Forage & Weed ID and Management Training Project
Composition of commercial mixtures

Species richness of commercial mixtures
58 mixtures from 10 seed companies

Number of species in mixture

Percentage of all mixtures

Source: Matt Sanderson

New England Forage & Weed ID and Management Training Project
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

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<tr>
<th></th>
<th>Company A</th>
<th>“Highland” mix</th>
<th>Company B</th>
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<tbody>
<tr>
<td>Perennial ryegrass</td>
<td>30%</td>
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<tr>
<td>Orchardgrass</td>
<td>20%</td>
<td>Orchardgrass (2 varieties)</td>
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<td>Tall fescue</td>
<td>20%</td>
<td>Meadow bromegrass</td>
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<td>Kentucky bluegrass</td>
<td>14%</td>
<td>Alaska bromegrass</td>
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<tr>
<td>Red clover</td>
<td>12%</td>
<td>Alfalfa</td>
<td>41%</td>
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<tr>
<td>White clover</td>
<td>4%</td>
<td>White clover</td>
<td>3%</td>
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<tr>
<td></td>
<td></td>
<td>Chicory</td>
<td>2%</td>
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</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

New England Forage & Weed ID and Management Training Project
Northeast SARE Study Results

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

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

Number of species in mix

Dry matter yield, lb/acre

New England Forage & Weed ID and Management Training Project
Shotgun Mix or Targeted Diversity? (Functional)

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

New England Forage & Weed ID and Management Training Project
Targeted (Functional) Approach

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

Source: Matt Sanderson

New England Forage & Weed ID and Management Training Project
What should I plant?

Site conditions

Grazing?

How many cuttings?

For How long?

Carl Majewski
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New England Forage & Weed ID and Management Training Project
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?
Considerations When Choosing Annual Forages

Rick Kersbergen
Richard.kersbergen@maine.edu

New England Forage & Weed ID and Management Training Project
New England Forage & Weed ID and Management Training Project
<table>
<thead>
<tr>
<th>Hybrid</th>
<th>RM</th>
<th>% Dry Matter</th>
<th>Crude Protein (%DM)</th>
<th>ADF (%DM)</th>
<th>NDF (%DM)</th>
<th>NFC (%DM)</th>
<th>NEL (McAL/lb)</th>
<th>IVTD30hr (% of DM)</th>
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<td>0.77</td>
<td>84</td>
<td>63</td>
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Table 3. Varieties and yield, 2014.

<table>
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<tr>
<th>Hybrid</th>
<th>RM</th>
<th>Yield, 30% DM (tons/acre)*</th>
<th>Expected milk yield (lbs/acre)**</th>
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*Means followed by the same latter are not statistically different (Tukey’s HSD)

**Expected milk yield = calculated milk lbs/ton multiplied by dry matter yield. Calculated milk lbs/ton is a projection of potential milk yield per ton of forage dry matter, based on forage digestibility and energy content.
Figure 1. Relationship between milk per ton and milk per ac\textsuperscript{-1} for short season corn silage varieties grown in Alburgh, VT. Dotted lines represent the mean milk per ton\textsuperscript{-1} and milk per ac\textsuperscript{-1}.
Dairy One  2015

New for 2015: NIR Pro

We are pleased to introduce our new NIR Pro forage testing package to complement the new CNCPS version 6.5 biology. CNCPS 6.5 represents the latest theory in ration balancing and requires new values to drive it. NIR Pro is the NIR Prime package modified to include the following features:

* aNDFom - NDF expressed on an organic matter (om) or ash free basis replaces aNDF.
* uNDFom and NDFDom - undigested NDF and NDF digestibility analyzed and reported on an organic matter basis replacing the option of NDFD24, 30 and 48. uNDFom and NDFDom values are reported for 30, 120, and 240 hours. All three values are included and used in conjunction to better estimate the rate of fiber digestion or kd.
* Version 6.5 utilizes the NDFDom30, 120, and 240 and internally calculates the kd using Vensim, a mathematical tool to optimize models with dynamic components. Therefore, kd will not appear when aNDFom and uNDFom are measured and reported.
* Calibrations are available for corn silage, haylage and hay.
* Price: to introduce you to these new concepts, we’re offering a special 90 day introductory price of $25/sample good until 3/31/2015.
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/bilage
  - Grain/seed

Biodiversity...of feed, soil health, landscape

Summer/fall annuals provide diversity or “insurance” for changing climate conditions.

New England Forage & Weed ID and Management Training Project
Typical Summer Annuals

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

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

New England Forage & Weed ID and Management Training Project
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