


SARE PDP Webinar: Considerations When Choosing Forage and Pasture Plants

Sid Bosworth

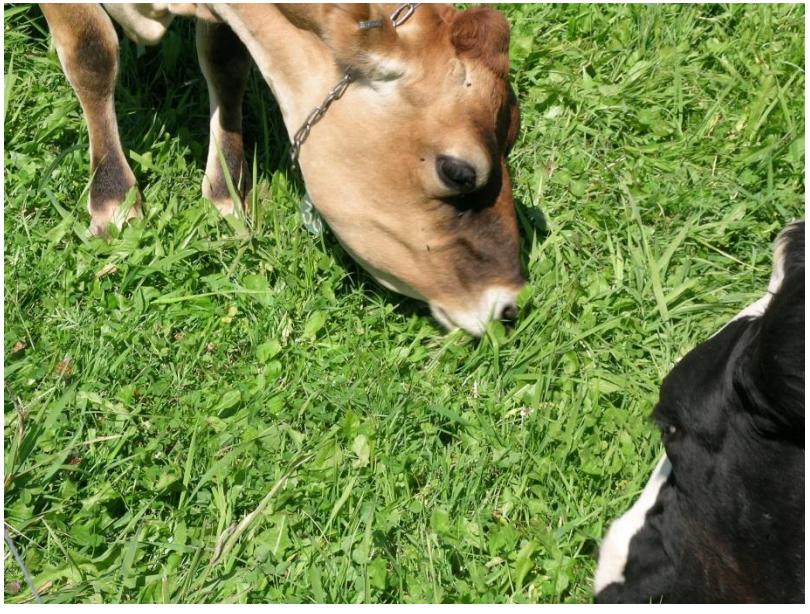
sid.bosworth@uvm.edu

Carl Majewski

Carl.Majewski@unh.edu

Rick Kersbergen

Richard.kersbergen@maine.edu



NORTHEAST SARE
Sustainable Agriculture Research & Education
Professional Development Program

New England Forage & Weed ID and Management Training Project



Species Considerations for Pasture and Hay



NORTHEAST SARE Sustainable Agriculture Research & Education Professional Development Program

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

Back to Home

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 pretaining 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

UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

Species	Soil Moisture Adaptation	Soil Fertility Adaptation	Drought Tolerance	Periods Of Production	Relative Maturity [1]	Growth Habit	Height Classification
Cool-Season Grasses							
Kentucky Bluegrass	Well-drained to moist	Good to medium	Poor	Early spring and late fall	Early	Dense sod - rhizomatous	Short
Timothy	Well-drained to moist	Medium to fair	Poor	Late spring and fall	Medium-late to late[2]	Bunch	Tall
Smooth Bromegrass	Well-drained	High to good	Good	Spring, summer and fall	Medium-late	Open sod - rhizomatous	Tall
Orchardgrass	Droughty to moist	Medium to fair	Good	Early spring, summer and fall	Early to medium[2]	Bunch	Tall
Reed Canarygrass	Droughty to wet	Medium to fair	Very good	Early spring, summer and fall	Medium-late	Open sod - rhizomatous	Tall
Tall Fescue	Droughty to moist	Medium to fair	Good	Early spring, summer and fall	Medium-late	Bunch[3]	Tall
Perennial Ryegrass[4]	Well-drained to moist	Good to medium	Poor	Early spring and late fall	Early to medium[2]	Bunch	Short to medium
Festulolium[4]	Well-drained to moist	Good to medium	Poor	Early spring and late fall	Early	Bunch	Medium

[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.

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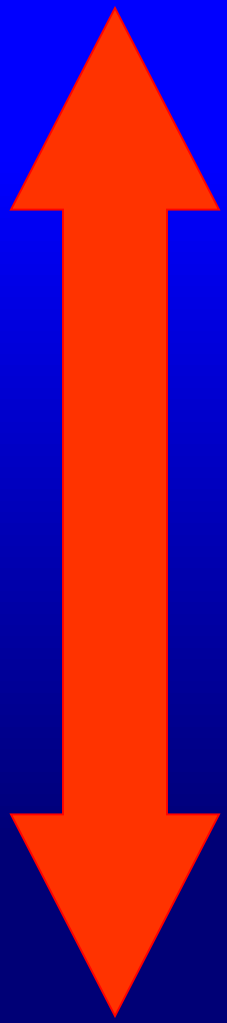
Winter Hardiness

Most Hardy



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

Least Hardy

Winter hardiness is very cultivar dependent for grasses and legumes

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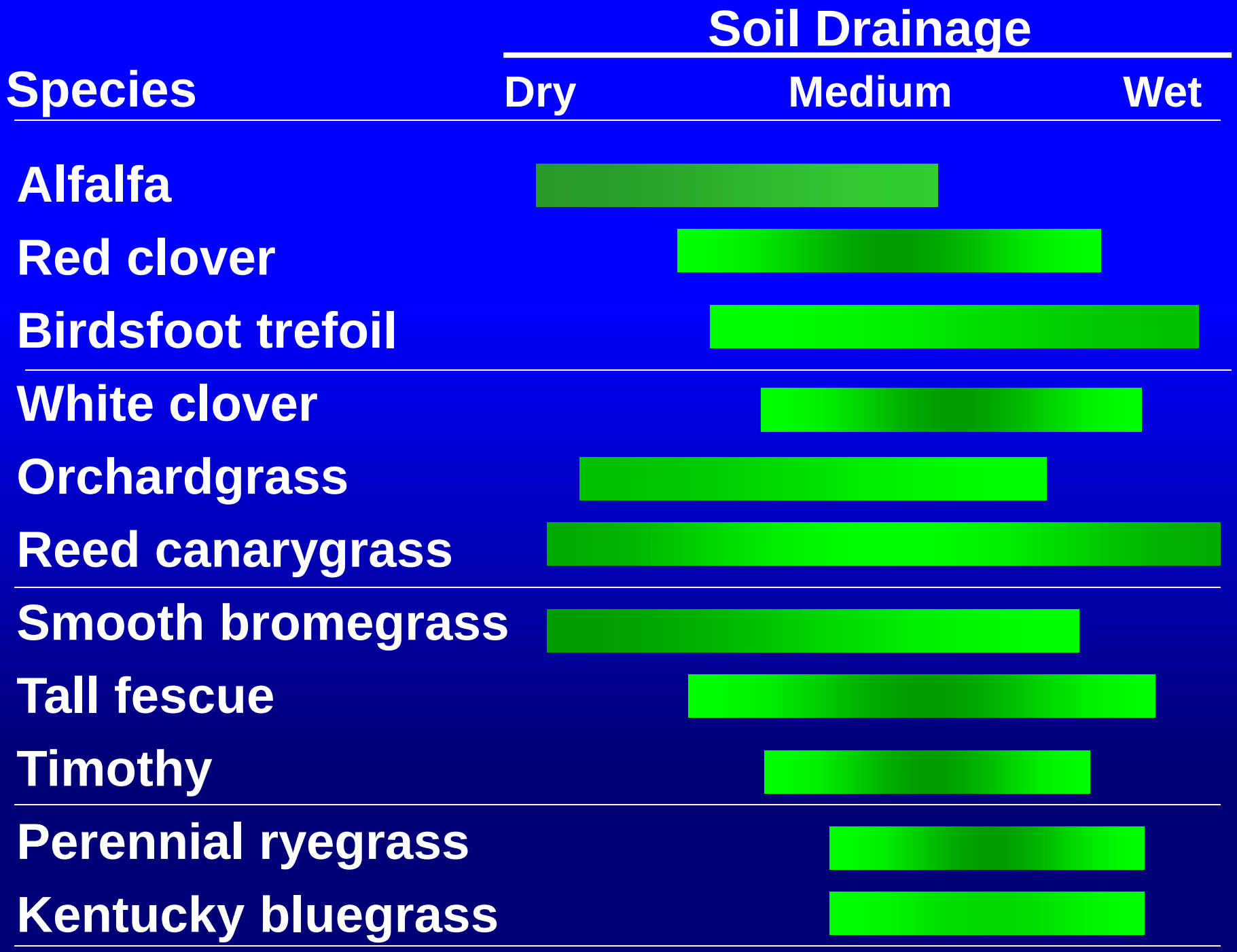

Soil Drainage
Species
Dry
Medium
Wet
Alfalfa
Red clover
Birdsfoot trefoil
White clover
Orchardgrass
Reed canarygrass
Smooth bromegrass
Tall fescue
Timothy
Perennial ryegrass
Kentucky bluegrass

Choose the right forage species…

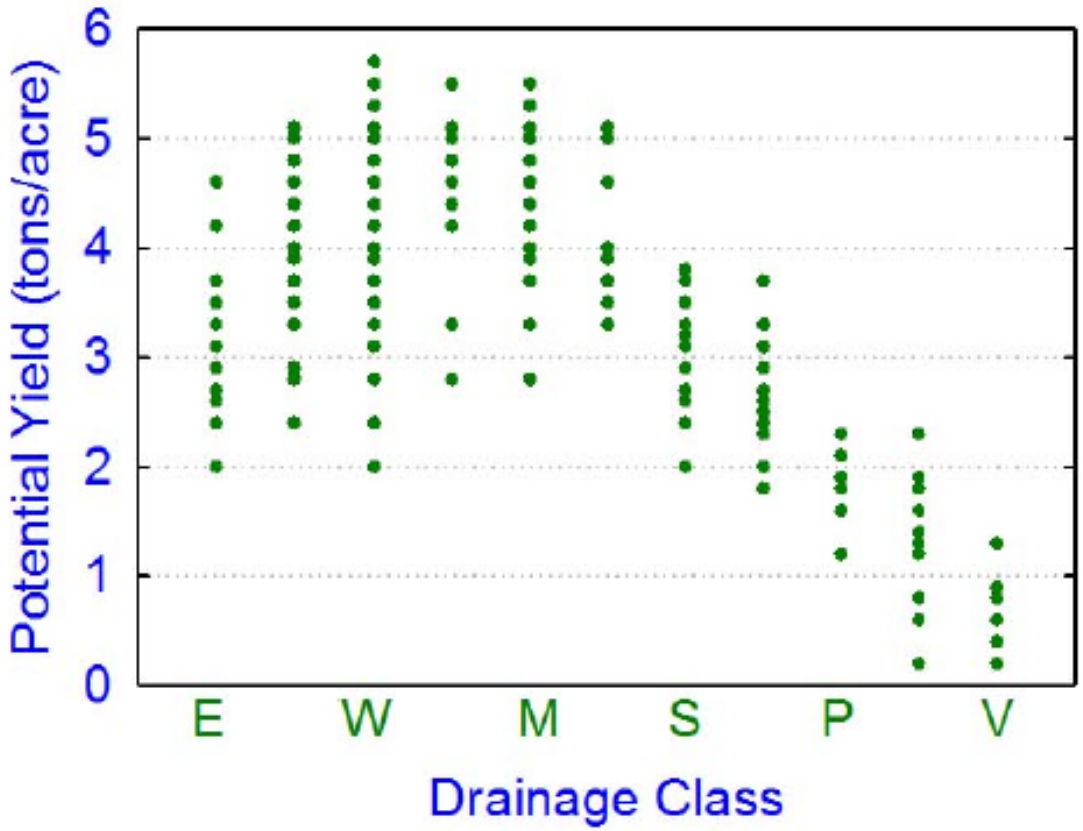


Figure 1. Orchardgrass yield potential on 640 NY soil types. Drainage classes are exceptionally well drained (E) to very poorly drained (V).

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

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

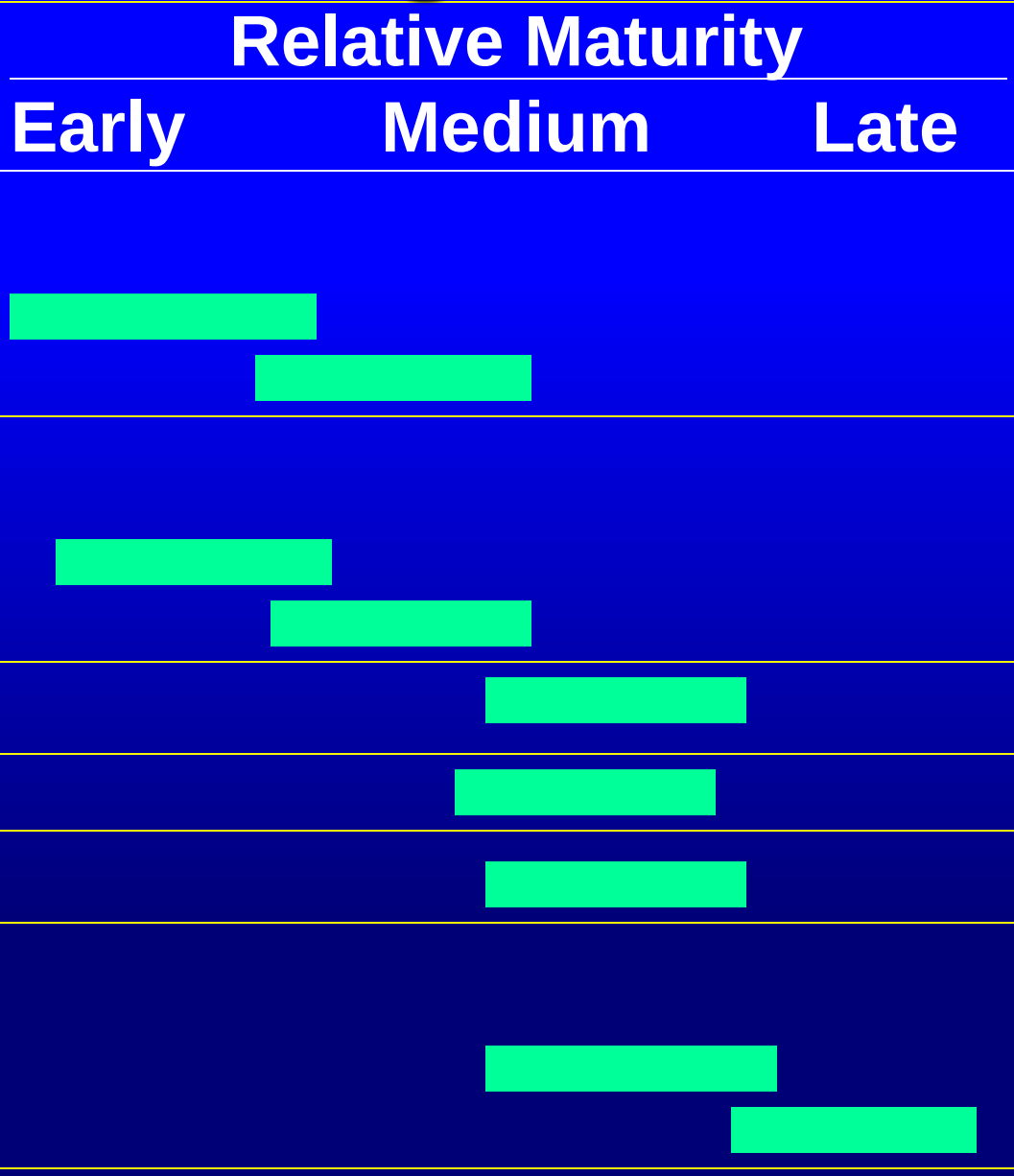
- Climate (Winter hardiness, drought, etc)
- Soil type and texture (adaptation to drainage)
- Length of stand (short rotation, long rotation, permanent)
- Type of harvest (pasture, hay, silage, mixed)
- **Desired forage quality and animal needs**
  - **Tolerance of intensive management**
  - **Time of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



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- **Specific animal/forage problems**
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Forage Selection Considerations

What's the best pasture or haycrop mixture?

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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

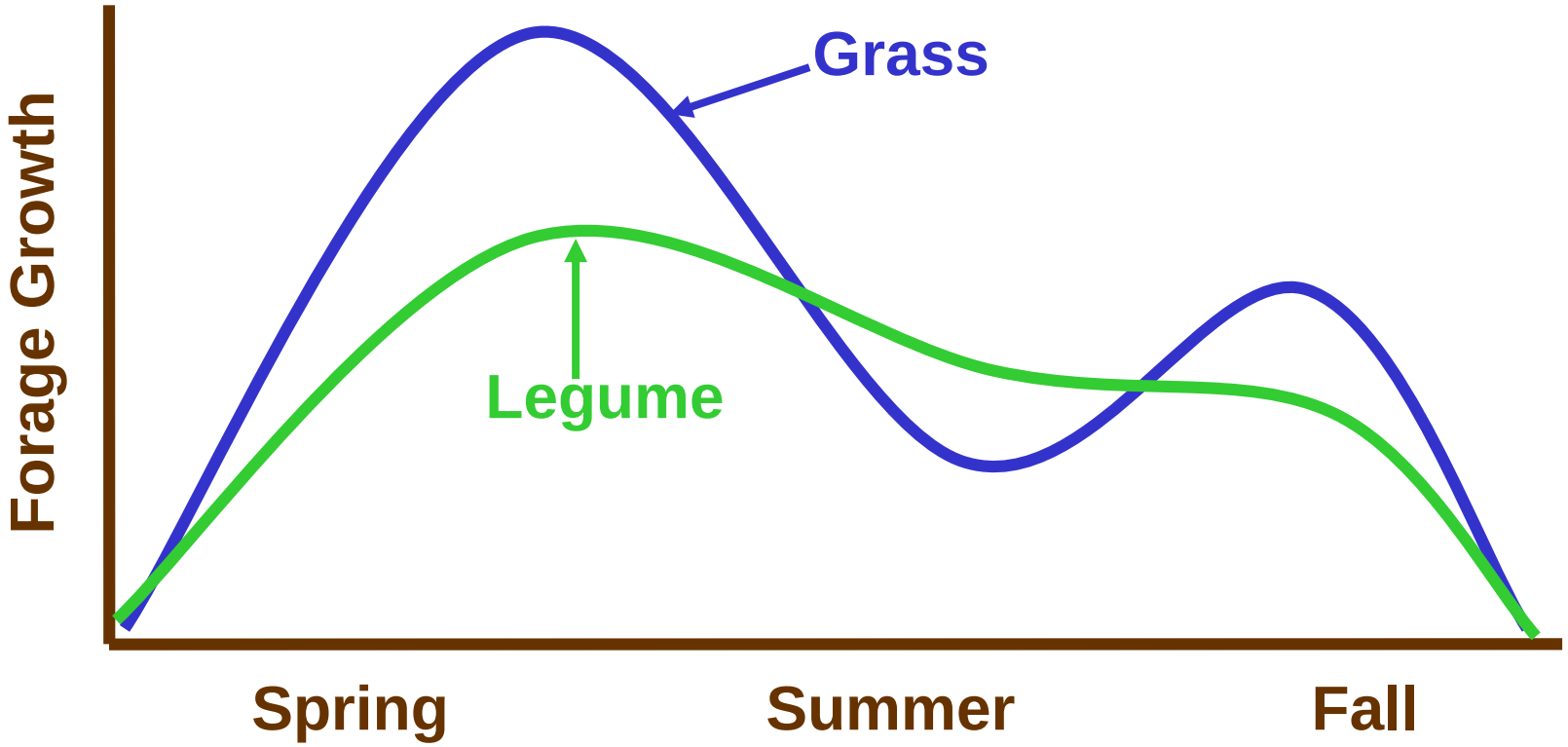
Advantages of Grass-Legume Mixtures

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

- Legumes increase protein concentrations in the mixture

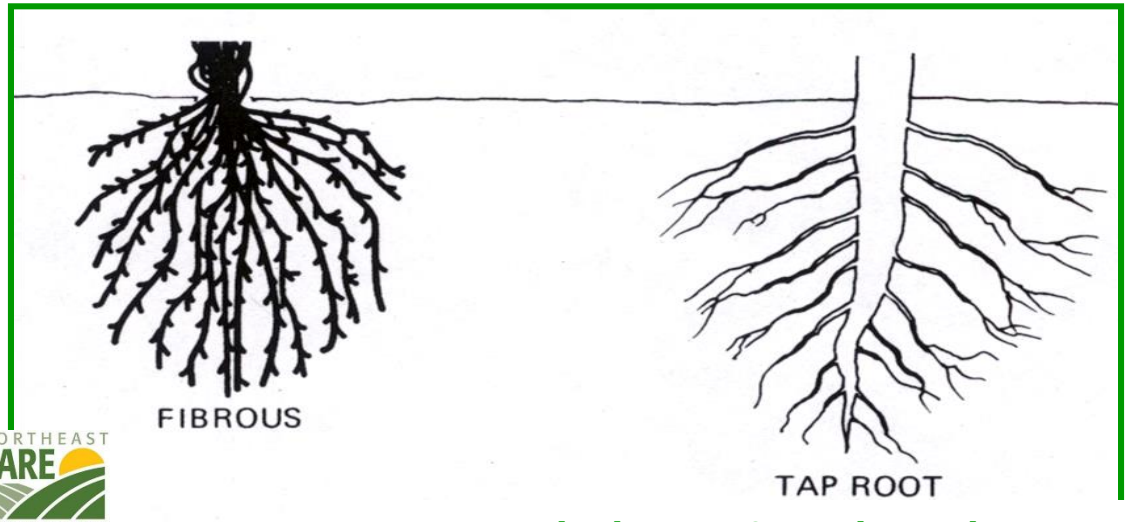
Advantages of Grass-Legume Mixtures

- **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**

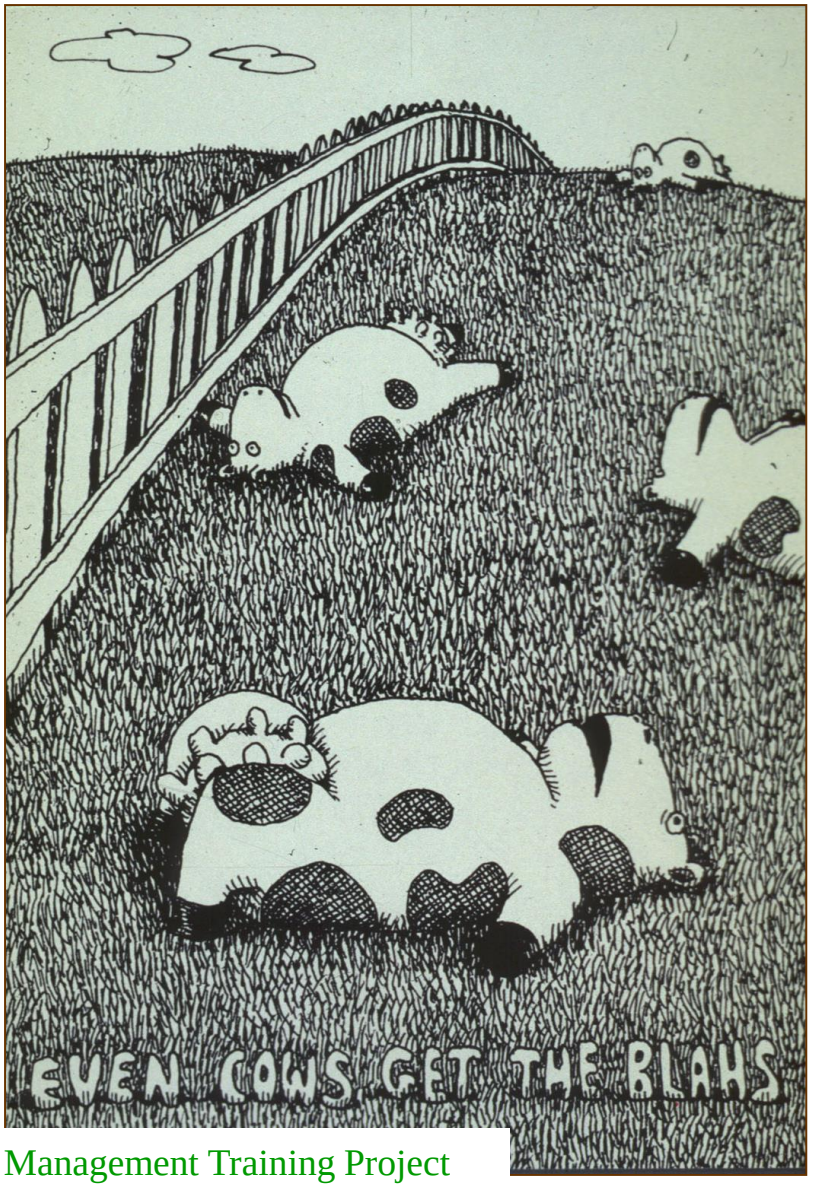
Advantages of Grass-Legume Mixtures

- 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

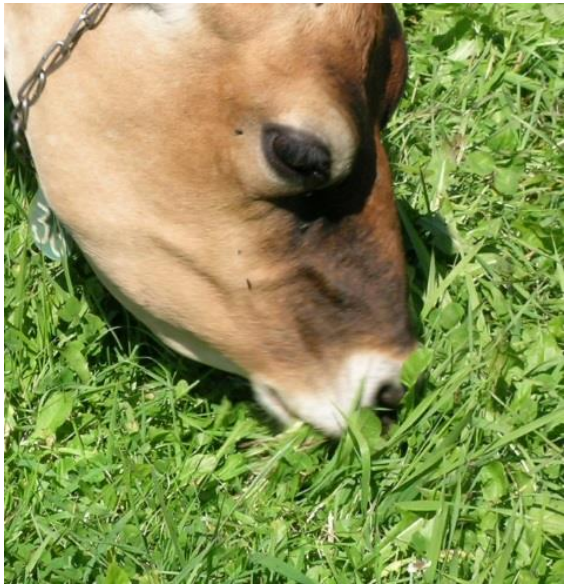
	Animal Requirement	Plant Levels	
		Grasses	Legume
	-%dm -	- - %dm - -	
P	0.20 - 0.43	0.2 - 0.5	0.2 - 0.5
Ca	0.18 - 0.60	0.2 - 1.0	1.2 - 2.5
Mg	0.05 - 0.20	0.1 - 0.3	0.2 - 0.4

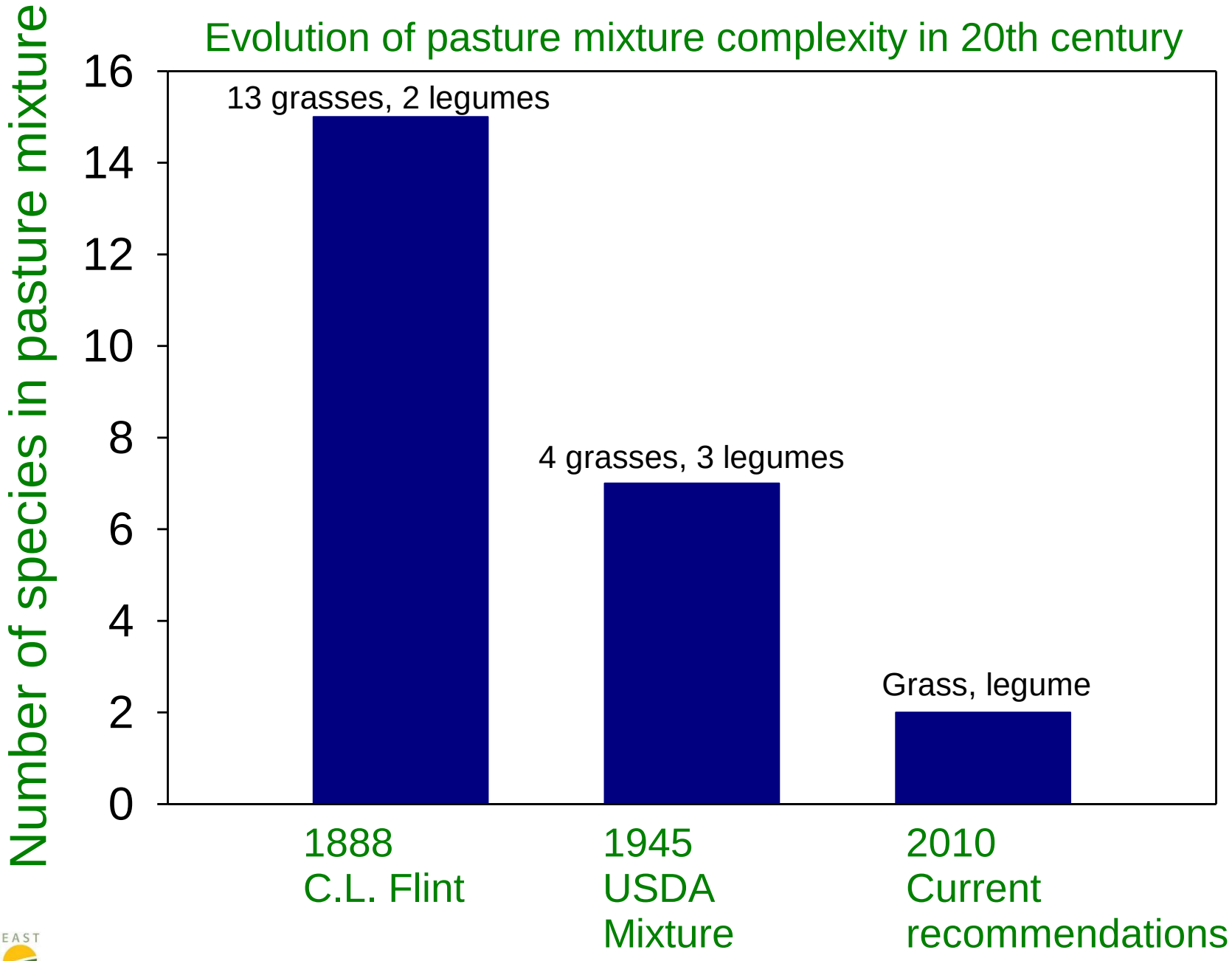
What Is The Objective For The Mixture

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

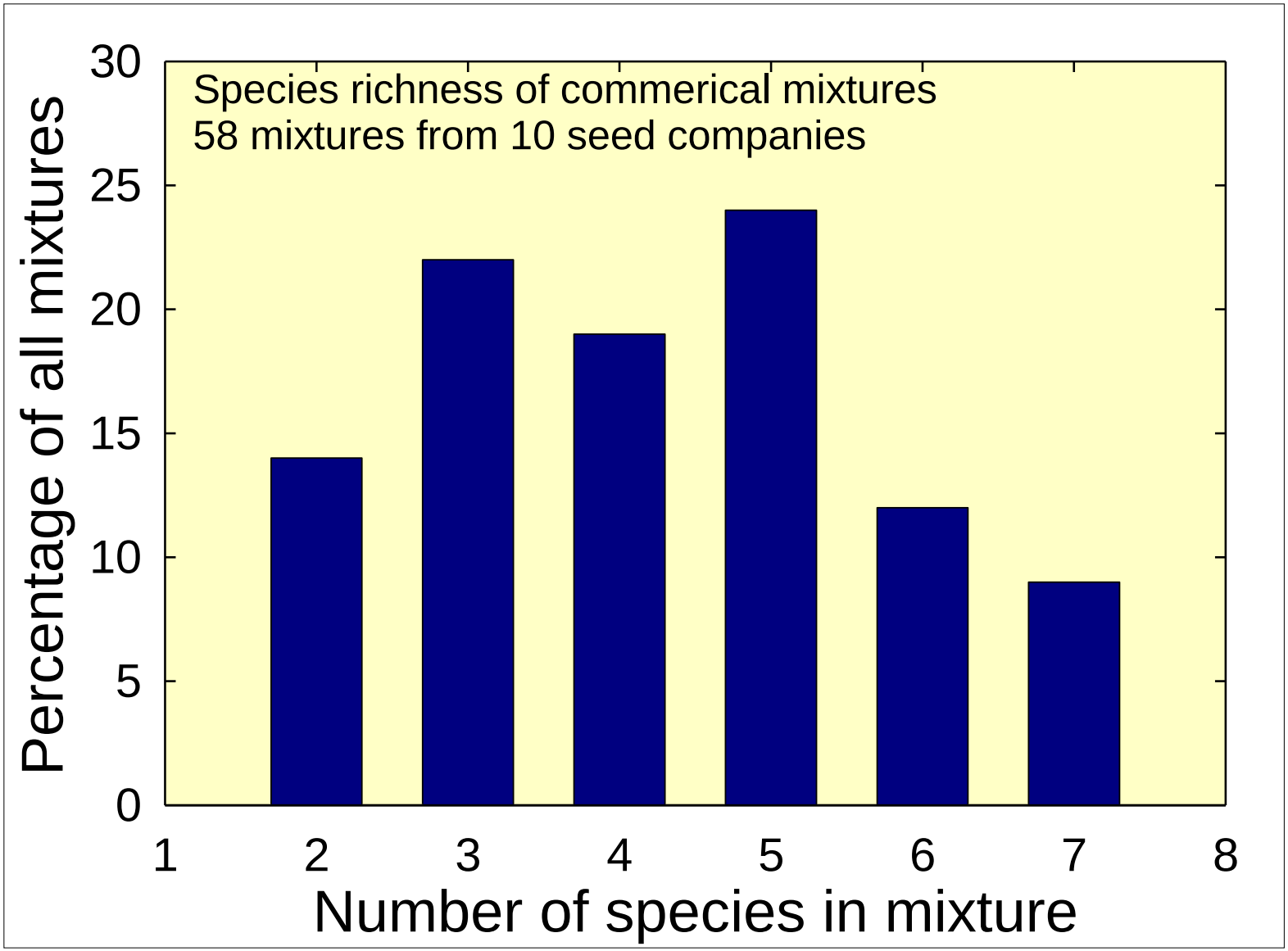
Formulating Mixtures

- 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
Number of species in pasture mixture
16
14
12
10
8
6
4
2
0
13 grasses, 2 legumes
4 grasses, 3 legumes
Grass, legume
1888
C.L. Flint
1945
USDA
Mixture
2010
Current
recommendations

Composition of commercial mixtures



Source: Matt Sanderson

Formulating Mixtures

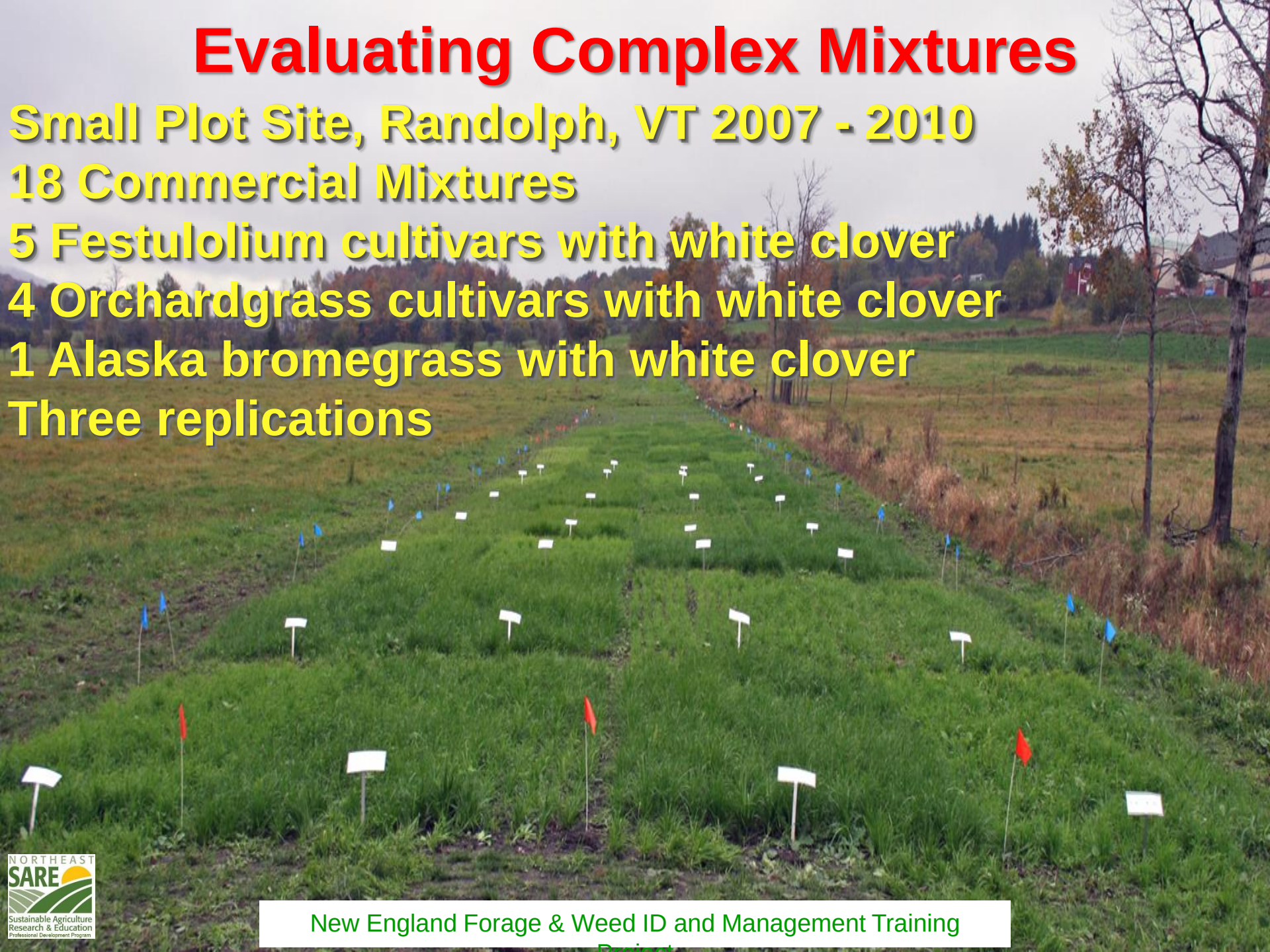
- What about using Commercial Brand Mixtures from my local seed dealer?
- Does it have what you need?
  - Species
  - Varieties
- Do they include certified, named cultivars or “common” cultivars?
- Mixtures may change from year to year
- Mixtures change among companies

Composition of commercial mixtures

"Highland" mix			
Company A		**Company B**	
Perennial ryegrass	**30%**	**Perennial ryegrass**	**9%**
Orchardgrass	**20%**	**Orchardgrass (2 varieties)**	**13%**
Tall fescue	**20%**	**Meadow bromegrass**	**14%**
Kentucky bluegrass	**14%**	**Alaska bromegrass**	**12%**
Red clover	**12%**	**Alfalfa**	**41%**
White clover	**4%**	**White clover**	**3%**
		Chicory	**2%**

Source: Matt Sanderson

Evaluating Complex Mixtures



Small Plot Site, Randolph, VT 2007 - 2010

18 Commercial Mixtures

5 Festulolium cultivars with white clover

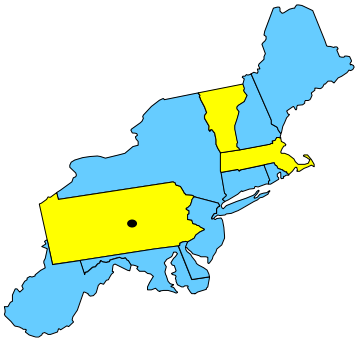
4 Orchardgrass cultivars with white clover

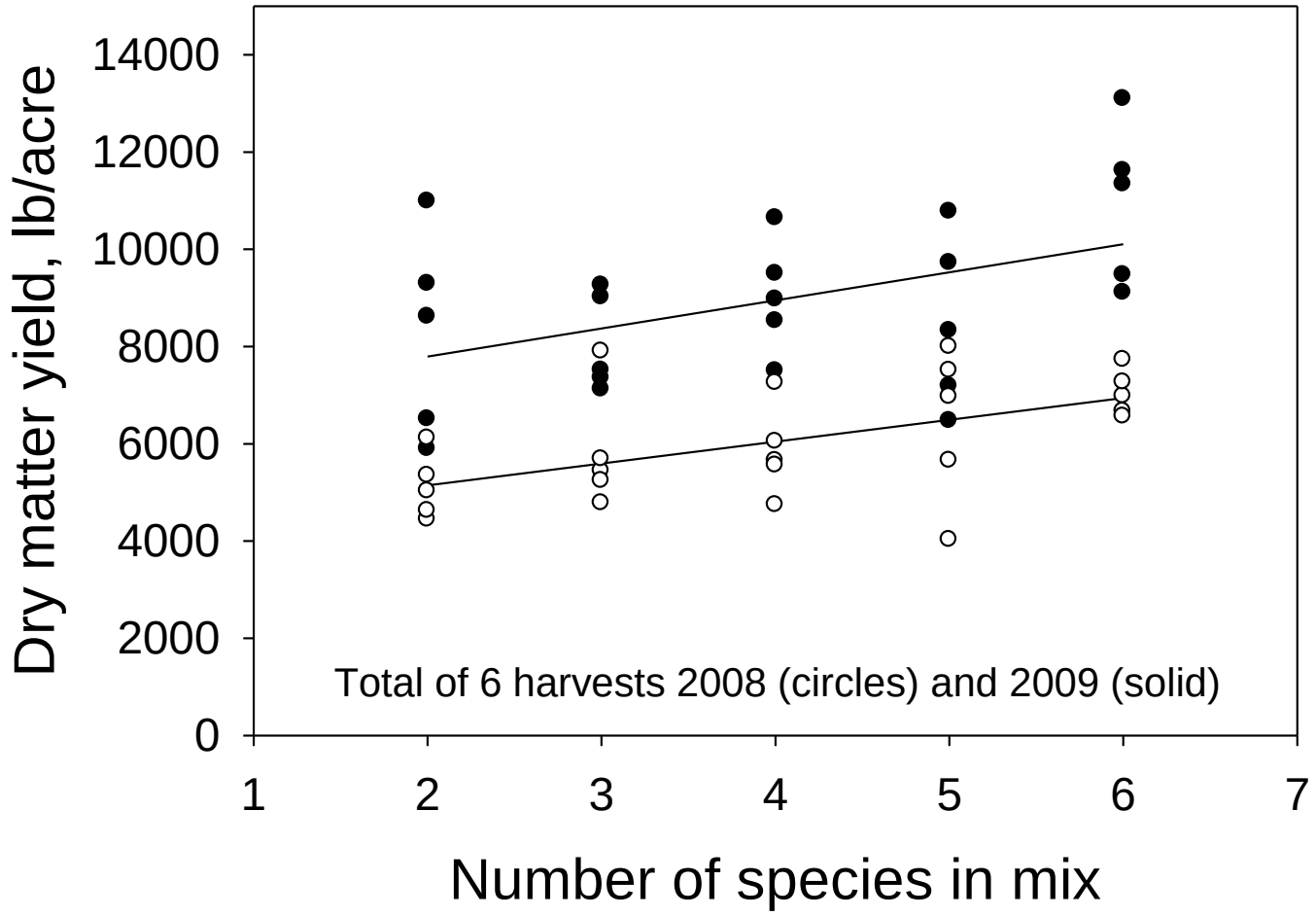
1 Alaska bromegrass with white clover

Three replications

Northeast SARE Study Results

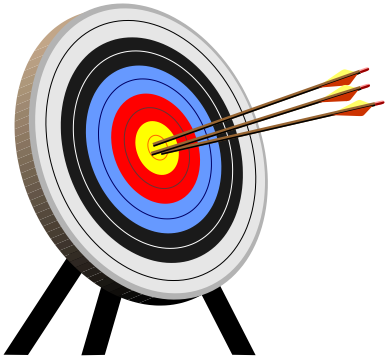
25 to 30 commercial mixtures evaluated under grazing in Massachusetts, Pennsylvania, and Vermont





Shotgun Mix or Targeted Diversity?

(Functional)



<u>Targeted (Functional) Approach</u>:

Drought paddocks
High quality paddocks
Annual paddocks
Medicinal paddocks?

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

Source: Matt Sanderson

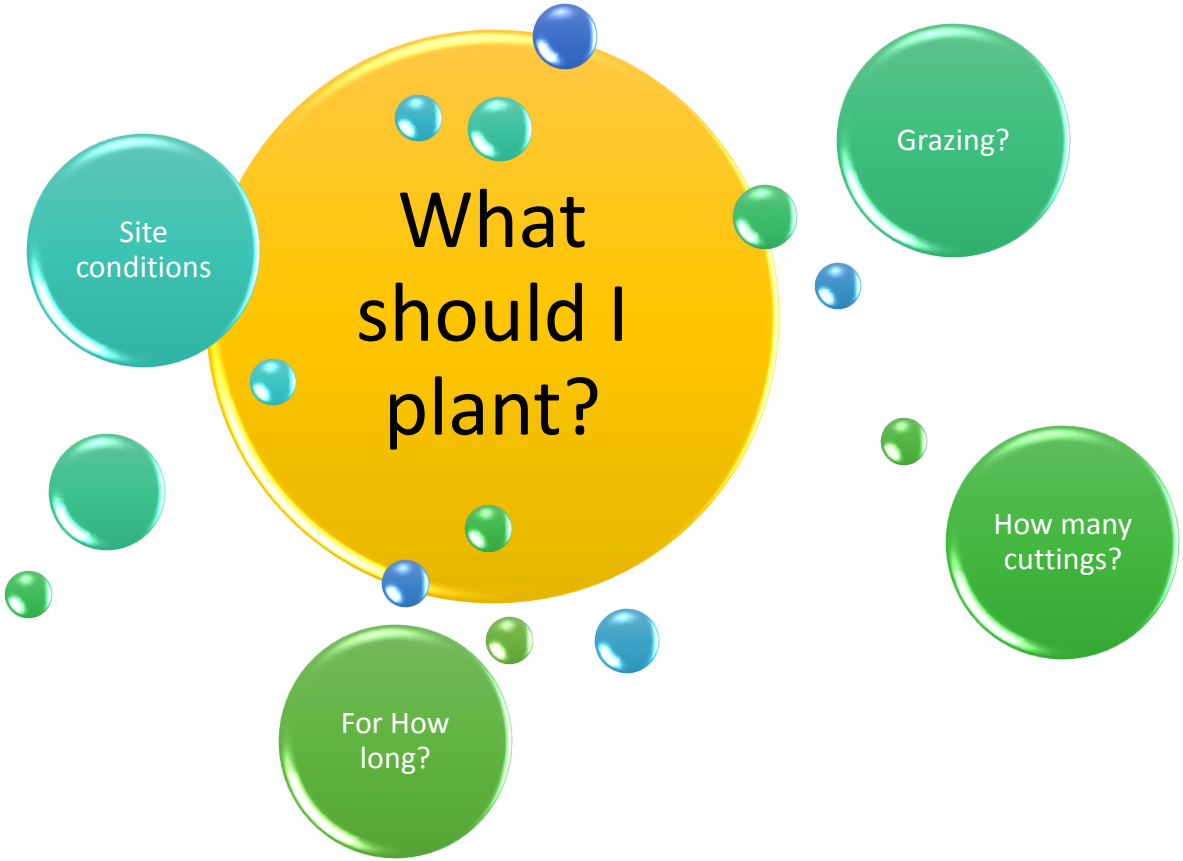
Targeted (Functional) Approach

Alfalfa
Orchardgrass
hay

Alfalfa
Orchardgrass
Chicory
pasture

Reed canary
trefoil
pasture

Source: Matt Sanderson



Carl Majewski
Carl.Majewski@unh.edu


Tolerance to grazing pressure
Orchardgrass
Ladino clover
Kentucky bluegrass
Tall fescue
Perennial ryegrass
Brassicas
Meadow fescue
Birdsfoot trefoil
Small grains
Summer annual grasses
Grazing
Mech.
Harvest
Both
Red clover
Alsike clover
Smooth brome
Timothy
Alfalfa
Reed canarygrass
Reed canarygrass
Droughty
Poorly drained

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

http://umaine.edu/waldo/files/2010/01/Silage-Trial-Report-2014-01-23.pdf

THE UNIVERSITY OF MAINE
Cooperative Extension
A Member of the University of Maine system

2014 Maine Corn Hybrid Performance Trial

Funding provided by local seed companies and the University of Maine Cooperative Extension.

Special thanks to John Stoughton and the farm crew at Misty Meadows Farm for hosting the trial and helping with planting and harvesting.

Rick Kersbergen
342-5971 / 800-287-1426
richard.kersbergen@maine.edu

Caragh Fitzgerald
622-7546 / 800-287-1481
cfitzgerald@maine.edu

Hybrid	RM	%Dry Matter	Crude Protein (%DM)	ADF (%DM)	NDF (%DM)	NFC (%DM)	NEL (Mcal/lb)	IVTD30hr (% of DM)	NDFD30hr (% of NDF)
American Organics 90G	90	23.5	8.4	25.6	43.2	39.8	0.76	83	60
American Organics PB5301	83	24.7	8.4	28.6	49.1	35	0.71	82	64
American Organics PB6474	94	23.6	8.3	24.9	43.3	42.3	0.78	83	60
Dairyland HiDF-3290-9	90	27.3	8.2	22.1	38.8	46.9	0.83	86	65
DeKalb DKC 34-82	84	27	9.5	25.4	44.2	39.1	0.76	81	57
DeKalb DKC 39-07	89	28.4	8.2	24.1	41.2	43.9	0.78	82	56
DeKalb DKC 43-48	93	25.6	7	26.5	51	33.7	0.69	78	57
DeKalb DKC 46-20	96	26.2	7.5	23.6	41.1	44.4	0.79	83	60
Dynagro D26VP56	86	26.8	8.5	25.1	42.8	41.2	0.76	81	56
Dynagro D32VC56	92	26.2	7.9	22.5	39.2	46.8	0.81	84	59
Dynagro D35VC40	95	26.5	8.2	22.3	39.4	46.2	0.8	83	57
Masters Choice MC 3221	82	32	8.1	24.2	41.2	43.8	0.77	80	52
Masters Choice MC 4050	90	22.8	8.6	26.5	44.7	39.5	0.76	81	58
Masters Choice MC 4211	92	28.3	8.3	23.4	39.4	45.6	0.8	83	56
Masters Choice MC 480	87	25	7.3	28.8	48.6	37.1	0.73	81	60
Mycogen 2DO95	80	27.9	8.9	26.6	44.2	39.2	0.77	82	60
Mycogen F2F378 bmr	94	24.8	8	27.1	46.8	38	0.76	85	68
Mycogen TMF2Q413	98	28.3	7.6	26.3	43.2	42.4	0.77	84	63

Table 3. Varieties and yield, 2014.

Hybrid	RM	Yield, 30% DM (tons/acre)*		Expected milk yield (lbs/acre)*,**	
American Organics 90G	90	20.6	e-h	20267	h-n
American Organics PB5301	83	20.5	e-h	19171	j-n
American Organics PB6474	94	24.5	a-f	22427	d-l
Dairyland HiDF-3290-9	90	27.6	ab	29277	ab
DeKalb DKC 34-82	84	20.8	e-h	21103	f-m
DeKalb DKC 39-07	89	24.9	a-e	25058	a-h
DeKalb DKC 43-48	93	23.3	a-g	18460	l-n
DeKalb DKC 46-20	96	24.4	a-f	25613	a-g
Dyna[illegible]D26VP56	86	21.4	d-h	21904	e-m
Dynagro D32VC[illegible]	92	25.1	a-e	26012	a-f
Dynagro D35VC40	95	24.4	a-f	25607	a-g
Masters Choice MC 3221	82	24.7	a-f	25570	a-g
Masters Choice MC 4050	90	20.5	e-h	20064	i-n
Masters Choice MC 4211	92	25.9	a-d	26859	a-d
Masters Choice MC 480	87	22.4	c-g	20974	g-m
Mycogen 2DO95	80	20.0	f-h	20428	h-n
Mycogen F2F378 bmr	94	21.6	d-h	22019	d-m
Mycogen TMF2Q413	98	28.2	a	28659	a-c
Mycogen TMF2R196RR	84	23.7	a-g	22254	d-l
NK N18Q-3011A	84	20.2	e-h	20531	h-n
NK N20Y-3220	85	23.3	a-g	21938	e-m
NK N28D-3111	90	27.3	a-c	29739	a
NK N29T-3220	92	23.2	b-g	24017	c-j
NK N31H-300GT	93	23.5	a-g	24519	b-i
NK N35T-3110	95	22.0	d-h	20778	g-m
NK N37R-2111	94	23.6	a-g	22918	d-l
Pioneer P0238XR	102	18.9	gh	18630	k-n
Pioneer P0783XR	107	19.9	f-h	17121	mn
Pioneer P9329AM	90	23.4	a-g	23540	d-k
Schlessman 835 GT 3122	83	24.8	a-f	26401	a-e
Schlessman 861 lfy GT[illegible]	86	24.6	a-f	22429	d-l
Schles[illegible]X 342 GT	95	24.5	a-f	23218	d-l
Seedway SW 1964GT	77	17.2	h	15735	n
Seedway SW 2901L	87	24.1	a-f	20995	g-m
Seedway SW 3301L	93	23.3	a-g	21582	e-m
Seedway SW 3937.bmr	94	20.7	e-h	22684	d-l

*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.

http://www.uvm.edu/extension/cropsoil

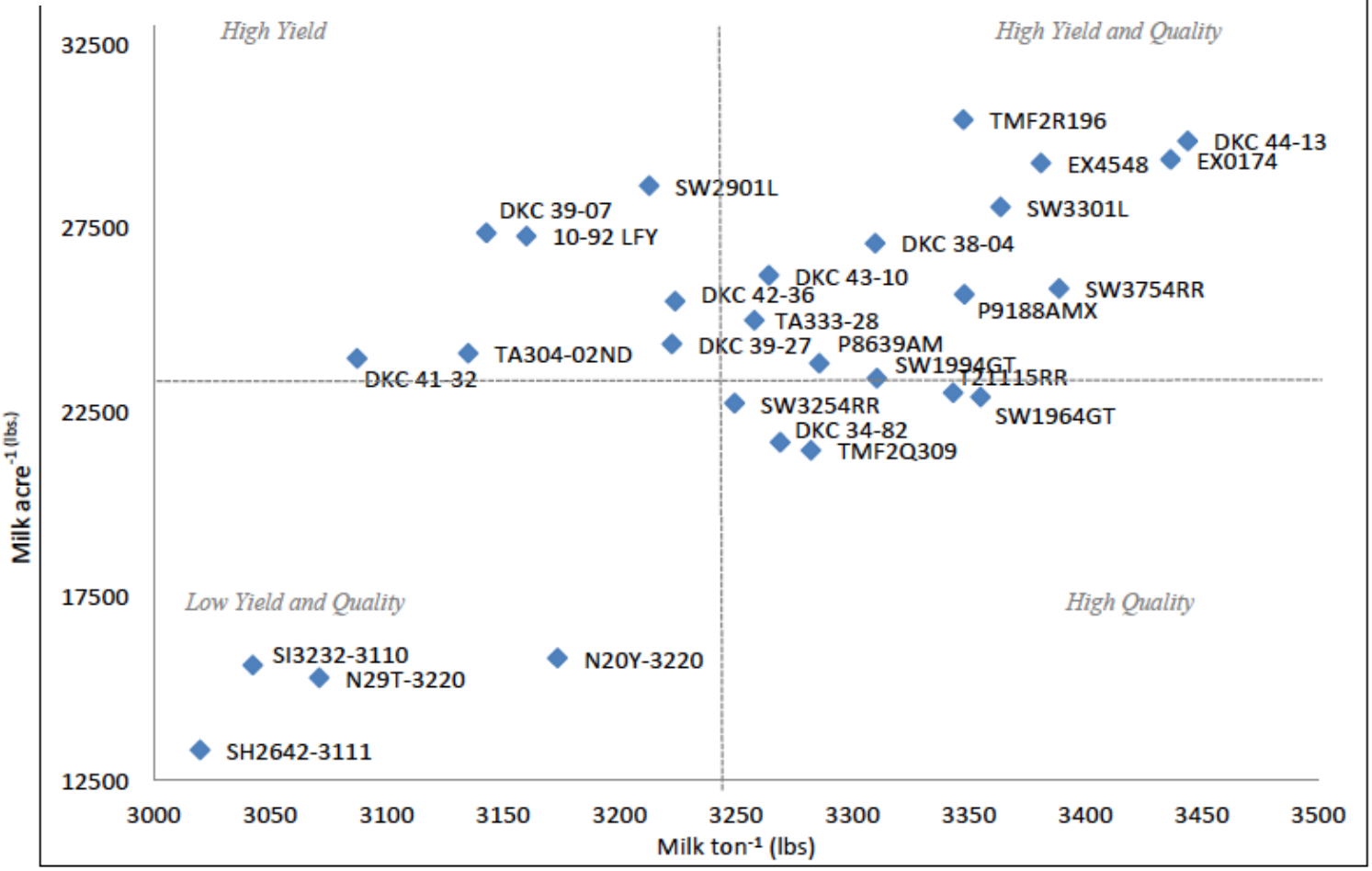


Figure 1. Relationship between milk per ton and milk per ac^{-1} for short season corn silage varieties grown in Alburgh, VT. ***Dotted lines represent the mean milk per ton^{-1} and milk per ac^{-1}.***

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

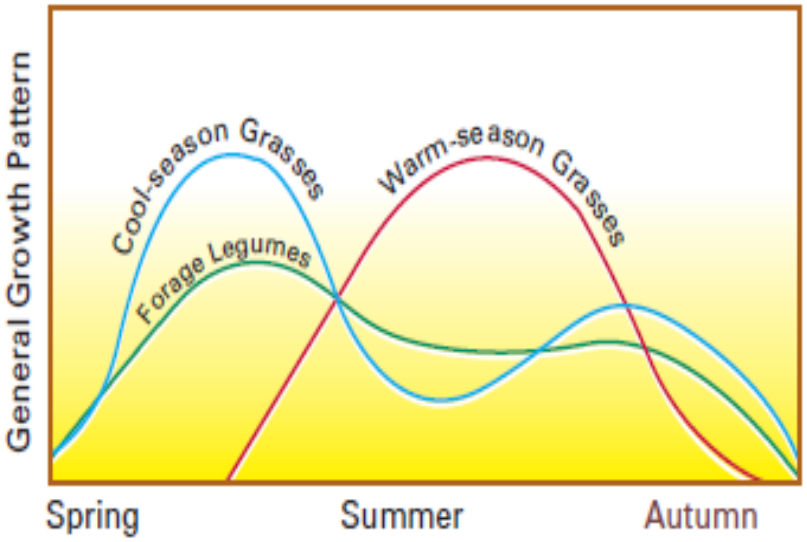
- Relative maturity (RM X 25 = GDD?)
- Yield (Compare on DM basis)
- Digestibility (NDFd---milk per ton---milk per acre)

---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/balage
  - Grain/seed



Biodiversity…of feed, soil health, landscape

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

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

Graze oats in fall – Planted Aug. 19th and grazed first of Oct.

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
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