

Genetics, Variety Development, and Species Selection

Forage Productivity is the function of:
**Genetics +
 Management +
 Environment**

Good genetics = good performance

- Correct forage species for the operation
- Best variety of those species for maximum performance
- Best management practices for the best outcomes
 - Provided, weather cooperates as well

Genetics vs. Variety and Species Selection

- About 10,000 grass species worldwide
- About 12,000 legume species worldwide
 - only ~40 used for hay, silage, and pastures
- A "Forage Manager" must be familiar with these grasses, legumes, and few other miscellaneous forages

Species and Variety Selection

Importance

Cost of Seeding:

Seed	\$20-40/acre
Tillage	\$20 or more
Drilling	\$10-15
Herbicide	\$0-20
Lost production	<u>\$70 or more</u>
	\$120-160/acre or more

If there is a partial success (or failure), an *inadequate stand not reseeded* will result in lost production over the life of the stand
i.e., 1/2 ton/year for 4 years is \$140/acre or more.

Species and Variety Selection

Species/variety selection based on:

- Adaptation – related to persistence
 - soil
 - climate
 - relevant pests
- High yield
- Intended use
- Local variety testing

Species and Variety Selection

Site and Species Selection:

A good *planning does half-of-the-job!* Should start planning at least a year ago ---

Matching species needs soil characteristics

- Soil surveys
- Soil tests
- Previous crop experience

Species and Variety Selection

Considering high-quality seed:

- Certified seed
 - guaranteed purity - genetics
 - free of noxious weeds
 - fewer other weeds
- Seed treatment
 - fungicide
 - seed coating
- Legume inoculation



Alfalfa

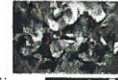
Importance

1. One of the oldest domesticated crops.
2. Grown in all 50 states.
3. Highest feeding value of the forages.



Genetics

- Currently > 300 varieties
- > 30 varieties per year released
- 9 major germplasm introductions into U.S.
Chile, Peru; Russia, Turkey; Flanders;



Species

- Medicago sativa* spp. *sativa* (purple flower alfalfa)
- Medicago sativa* spp. *falcata* (yellow flower alfalfa)
- Medicago sativa* spp. *media* (purple/green/yellow or "variegated")



Alfalfa

Adaptations/Requirements

- Deep well-drained soil
- Ph 6.5 or higher
- Lots of water
- Good fertility



Variety selection

- Look at variety trial results
- Disease resistance (multiple pest resistance)
- Avoid blends
- Buy certified
- Consider use (greater yields, purchase less protein, reduce winter feed costs, reduce N fertilizer bill)

Sainfoin

General Characteristics:

- Greater frost tolerance than alfalfa
- Very winter-hardy
- Early spring growth and maturity
- More water use efficient than alfalfa
- Less regrowth than alfalfa
- Short-lived under irrigation
- Tolerant to high-lime soils
- Doesn't tolerate wet soils or high-water table



Sainfoin

Varieties:

- Eski and Remont – MT
- Shoshone – WY (UW)
- Melrose and Nova - Canada
- Renumex – NM
- Delaney or UW RD – UW AES and MT AES, *the latest one!*

Importance:

- Non-bloating
- Extremely palatable
- More compatible with grasses than alfalfa
- Tolerates low P soils
- Excellent drought tolerance



Best Fit?

Dryland pastures with > 13" precipitation

IRRIGATED PERENNIAL GRASSES

Smooth brome

Adaptation

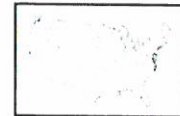
- Deep, well-drained, moist soil (same as alfalfa)
- Alaska, Canada, E. Great Plains-Northern Corn Belt
- >16 inches rainfall



Meadow brome

Adaptation

- Much more limited
- Intermountain West



Northern type of smooth brome best adapted to Canada (Belt states; Nebraska and Wyoming are transition zones). Meadows brome use the southern type. Brome does just fine at 40°N latitude (30°N degree N. latitude).

IRRIGATED PERENNIAL GRASSES

Timothy



Adaptation:

- Not as widely adapted as smooth brome
- Cool, moist areas
- Tolerant of acidity
- Tolerant of wetness, some flooding
- Low tolerance of drought or salinity

Uses:

- First growth – hay
- Regrowth - pasture
- Standard for horses
- Easily over-grazed

Note: Avoid sandy soils!

IRRIGATED PERENNIAL GRASSES


Creeping Foxtail

Adaptation:

- Mostly Intermountain West
- Annual precipitation - strictly irrigated
- Winter hardiness: excellent
- Salinity tolerance: good
- Wet soil/flooding tolerance: excellent
- Drought tolerance: none
- Heat tolerance: little

Use:



- Hay + Pasture: early greenup in spring; excellent palatability; good grazing tolerance
- Conservation use



Orchardgrass

Adaptation:


- Annual precipitation needs >18 inches
- Salinity tolerance - little
- Wet soil tolerance - little
- Flooding tolerance - none
- Drought tolerance - limited
- Heat tolerance - good
- Shade tolerance - good

Orchardgrass

Uses:

- Pasture preferred over hay
- Season - average earliness
- Growth habit - lots of basal leaves
- Regrowth - excellent
- Palatability - excellent because of very soft leaves
- Grazing tolerance - dependent on management



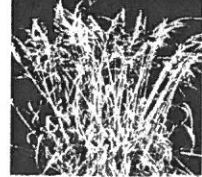


Tall fescue

*(Festuca arundinacea Schreb.) – old name
Lolium arundinaceum (Schreb.) Darbysh
Schedonorus arundinaceus (Schreb.) Dumort.
Family: Poaceae
Origin: Europe, Africa*

Description/Characteristics:

- Cool-season perennial
- Bunch grass (mainly); sod forming too
- Seed head a panicle






Bunch type, excellent seed production potential

Tall fescue

Adaptation:

- Adapted to humid, temperate areas
- Annual precipitation >16 in.
- Winter hardiness - good
- Salinity tolerance - good
- Wet soil/flooding tolerance - good
- Drought tolerance - good
- Heat tolerance - good





Reed canarygrass

- Cool-season perennial
- Long-lived
- Sod-forming

Adaptation:


- Annual precipitation - >16 in.
- Winter hardiness - excellent
- Salinity tolerance - little
- Wet soil/flooding tolerance - excellent
- Drought tolerance - good
- Heat tolerance - poor

Reed Canarygrass

Uses and Management:



- Pasture preferred over hay
 - Forage quality decline
 - Palatability - good until near heading
 - Grazing tolerance - good
- Conservation use -waterways, ditch banks, not irrigation ditches
- Difficult to establish because of slow emergence; once established - vigorous and invasive in wet sites



Intermediate wheatgrass

Adaptation:


- Annual precipitation >14 in.
- Salinity tolerance - moderate
- Wet soil/flooding tolerance - little
- Drought tolerance - good
- Heat tolerance - little

Intermediate wheatgrass

Use and management:

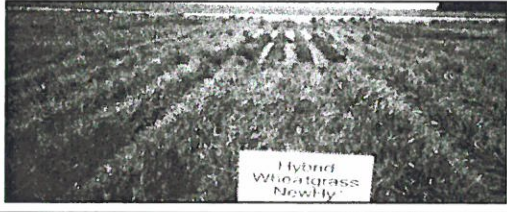
- Establishment -relatively easy to establish, high seedling vigor
- Compatibility with legumes - compatible with alfalfa, particularly under dryland
- Palatability - fair to good
- Regrowth - limited
- Growth habit - upright, suitable for haying
- Hay vs pasture - useful for pasture or haying



Hybrid wheatgrass
Bluebunch wheatgrass x quackgrass

Agropyrum (Pseudoroegneria) spicatum x Agropyrum (Elytrigia) repens

Cultivar: 'Newhy'
- good salt tolerance



IRRIGATED PERENNIAL GRASSES

Species Selection for Specific Situations:

1. **Wet, poorly drained, low salinity**
 - Smooth brome grass
 - Meadow brome grass
 - Timothy
 - Creeping foxtail
 - Orchard grass
 - Tall fescue
 - Reed canary grass
 - Intermediate wheat grass
 - Hybrid wheat grass

Recommendation:
- timothy, creeping foxtail, tall fescue, and reed canary grass

IRRIGATED PERENNIAL GRASSES

Species Selection for Specific Situations:

2. Well-drained, high salts

- Smooth bromegrass
- Meadow bromegrass
- Timothy
- Creeping foxtail
- Orchardgrass
- Tall fescue
- Reed canarygrass
- Intermediate wheatgrass
- Hybrid wheatgrass

Recommendation:

- tall fescue, hybrid wheatgrass (best)

IRRIGATED PERENNIAL GRASSES

Species Selection for Specific Situations:

3. Mixture with alfalfa for pasture

- Smooth bromegrass
- Meadow bromegrass
- Timothy
- Creeping foxtail
- Orchardgrass
- Tall fescue
- Reed canarygrass
- Intermediate wheatgrass
- Hybrid wheatgrass

Recommendation:

- smooth brome, meadow brome, orchardgrass, tall fescue, intermediate wheatgrass, (possibly hybrid wheatgrass)

Grass-Legume Mix to Reduce Nitrogen Fertilization

Objective:

- Identify an optimal grass-legume balance in mixture that sustains high yield stability over time
- Quantify legume nitrogen contribution to grass growth, and its variation across environments

Methods/approach:

- One grass (MaxQ tall fescue)
- One legume (alfalfa, Ameristand 403T)
- 10 treatments, replicated 3 times
- 5 grass-legume mix: 1:0; 0.75:0.25; 0.50:0.50; 0.25:0.75; 0:1
- 5 N rates: 45; 90; 135; 180; and 270 lb/acre
- Planting date: Sep 10, 2009; seeding rate: 22 lb PLS/acre
- Harvests: 2010-2012, early June, late July, early October; 2013, early June, late July, early October



Grass-Legume Mix to Reduce Nitrogen Fertilization

Results:

Dry matter yield (lb/A) of tall fescue-alf

Trt	TF-Alf	1st cut	2nd cut	3rd cut	Total	Increase/control (%)
1	TF-alf (1:0)	866	2675	890	4431	0
2	TF-alf (0:1)	1273	2180	1164	4618	4
3	TF-alf (0.75:0.25)	1302	2587	1726	5614	27
4	TF-alf (0.50:0.50)	1342	4529	3297	9169	107
5	TF-alf (0.25:0.75)	1197	3826	2252	7276	64
6	TF 45 lb N	1433	3149	1546	6128	38
7	TF 90 lb N	1162	2700	1677	5538	25
8	TF 135 lb N	1092	2860	1911	5864	32
9	TF 180 lb N	1096	3020	3126	7243	63
10	TF 270 lb N	1247	2502	2743	6492	46
LSD (0.05)		560	1583	1220	1983	

Harvests: 1st - 6/7/2010; 2nd - 7/26/2010; 3rd - 10/7/2010

Sustaining Legumes in Grasslands

Results:

Forage q

Trt	TF-Alf	ADF			NDF			IVTDM			CP			RFV		
		Cut			Cut			Cut			Cut			Cut		
		1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
1	TF-alf (1:0)	44	36	34	60	54	46	65	66	67	13	12	9	85	104	126
2	TF-alf (0:1)	40	33	35	47	40	44	64	70	67	20	19	17	116	149	131
3	TF-alf (0.75:0.25)	42	35	32	58	52	45	66	64	68	14	12	9	90	110	133
4	TF-alf (0.50:0.50)	43	36	33	60	56	47	67	66	67	14	13	10	87	101	126
5	TF-alf (0.25:0.75)	43	38	33	61	51	48	64	67	68	16	15	12	84	111	123
6	TF 45 lb N	41	35	32	53	52	45	65	67	70	15	13	12	104	110	132
7	TF 90 lb N	45	36	32	61	54	47	64	69	69	13	14	13	82	105	126
8	TF 135 lb N	44	36	32	61	55	48	67	67	70	14	14	16	84	103	124
9	TF 180 lb N	40	36	32	58	54	48	69	67	71	16	14	16	93	104	125
10	F 270 lb N	44	37	33	68	55	49	62	68	70	17	14	17	76	102	120
LSD (0.05)		5	2	2	9	6	3	8	3	3	3	3	2	23	13	11

Harvests: 1st - 6/7/2010; 2nd - 7/26/2010; 3rd - 10/7/2010

Minimum seeding rate in monoculture and mixture (lb/acre)

1. Alfalfa 8
2. Sweet clover 8
3. Birdsfoot trefoil 6
4. Alfalfa + Red clover 6+3
5. B. trefoil + Red clover 3+3
6. Red clover + Orchardgrass 5+3
7. B. trefoil + Orchardgrass 4+2
8. Alfalfa + Orchardgrass 6+3
9. Alfalfa + Bromegrass 6+8
10. Alf. + Brome + Orchard. 6+6+2

Source: Barnhart 2004

Summary

- ❑ Investigating what strengths each variety has been bred is helpful in making better selection
- ❑ Use as many resources as possible to determine the best variety for the needed uses
 - Seed catalogs, vendors, internet, extension publications, university website etc.
- ❑ Good planning is the key for successful pasture renovation/improvement
 - this needs to be planned at least a year ahead
- ❑ *As always, best returns depend on effective utilization and well-managed livestock and forage programs*

