Selecting Forage Species

Forage grass and legume performance varies depending on environmental conditions. No single forage type or variety is best in all environments. The selection of grasses and legumes is influenced by factors such as:

- · average rainfall,
- · soil drainage,
- · erosion hazard,
- · soil pH level,
- · nutrient supply, and
- · intended use(s).

The climatic adaptation of a species, or its potential longevity in the field, is determined greatly by genetic cold-hardiness traits.

When selecting a forage species, or several species for use in a seed mixture, first consider their appropriateness for the intended use (pasture, hay, etc.) and for the expected longevity on the site (Table 1).

Table 1. General Crop Use Information (E=excellent, G=good, F=fair, P=poor).

Crop	Annual or Perennial	Hay	Silage	Pasture (Grazing) Continuous	Pasture (Grazing) Controlled	Palatability
Legumes						
Alfalfa	Perennial	E	E	P	E	E
Alsike clover	Short-lived Perennial	G	G	P	G	E
Birdsfoot trefoil	Perennial	G	E	G	G	G
Cicer milkvetch	Perennial	F	G	G	G	E
Crownvetch	Perennial	F	G	F	G	G-F
Hairy vetch	Winter annual	Used primarily as a cover crop				
Lespedeza (Korean)	Annual	F	F	F	F	G
Ladino clover	Perennial	F	G	E	E	E
Mammoth red clover	Short-lived Perennial	F	G	P	P	G
Medium red clover	Short-lived Perennial	G	E	P	G	E
Kura clover	Perennial	G	G	E	E	E-G
Sweetclover	Biennial	F-P	G	P	F	F
Grasses						
Kentucky bluegrass	Perennial	G	G	E	E	E
Orchardgrass	Perennial	E	G	E	E	F
Perennial ryegrass	Short-lived Perennial	E	E	E	G	E
Redtop	Perennial	F	F	F	F	G-F
Reed canarygrass	Perennial	G	G	F	G	G-P
Smooth bromegrass	Perennial	E	E	F	E	E
Tall fescue	Perennial	G	G	G	G	F-P
Timothy	Perennial	E	E	F	G	E-G
Big bluestem	Perennial	F	F	F	G	G
Indiangrass	Perennial	F	F	G	G	G
Switchgrass	Perennial	F	F	F	G	G-F
Hyb Pearl Millet	Annual	F	F	F	G	G-F
SorghXSudan Hyb	Annual	P	G	F	G	G-F
Sudangrass	Annual	P	F	F	G	G-F
Foxtail/German Millet	Annual	F	F	F	G	F
Other						
Rape and Turnips	Annual	P	P	F	G	G-F
Chicory	Short-lived Perennial	P	P	G	G	G-P

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Once several possible candidates are selected, consider how these species might be suited to the conditions of your specific field(s) (Tables 2 and 3). Soil drainage and their relative tolerance of low soil fertility or pH conditions (Table 3) often limit the persistence of legumes. Table 2 categorizes species on the basis of their relative height and cautions about known potential anti-quality traits.

Mixtures of legumes and grasses often give the best overall performance for pasture and multi-use hay/pasture meadows. Yields tend to be greater with mixtures than with either a grass or legume alone. Mixtures of two or three well-chosen legumes or grasses are usually more desirable than mixtures that include five or six. Each selected grass and legume in the mixture should have a specific purpose.

Table 2. Crop description, relative tolerance of established forages to environmental hazards, and ease of establishment (E=excellent, G=good, F=fair, P=poor).

Forage crop	Cold-frost	Drought	Soil Wetness	Acidity	Ease of Establishment	Growth Habit*	Palatability	Anti-Quality Components**
Legumes								
Alfalfa[1]	G	G	P	P	G-E	T	E	B
Alsike clover	F	P	G	G	F	M	E	B,P
Birdsfoot trefoil[1]	G	F	G	G	P	M-S	G	T
Cicer milkvetch	G	G	F	G	P	T	E	P
Crownvetch	G	G	P	E	P	T	G-F	G
Hairy Vetch	F	F	F	F	G	Viny		
Lespedeza (Korean)[2]	P	G	P	F	G	S	G	T
Ladino clover	F	P	G	F	F	S	E	B
Mammoth red clover	F	P	F	F	G	M	G	B
Medium red clover	G	F	F	F	G-E	M	E	B
Kura clover	E	F	F	F	P	M-S	E	B
Sweetclover	G	G	P	P	F	T	F	B,C
Grasses								
Kentucky bluegrass	E	P	G	F	P	S	E	
Orchardgrass[3]	F	F	F	F	G	M-S	G	
Perennial ryegrass[3,4]	P	P	G	F	E	M-S	E	ET
Annual Ryegrass	P	P	G	F	E	M-S	G	
Redtop	E	G	F	E	F	S	G-F	
Reed canarygrass[4]	F	G	E	G	P	T	G-P	A
Smooth bromegrass	E	G	F	F	F	T-M	E	
Tall fescue[5]	E	G	G	E	G	T-M	F-G	A,ET
Timothy	G	F	P	G	F-G	M-T	E	
Big bluestem[3]	G	E	P	G	P	T	G	
Indiangrass[3]	F	E	P	G	P	T	G	
Switchgrass[3]	G	E	F	G	P	T	F	
Hyb. Pearl Millet	P	G	P	F	G	T	G	
Sudangrass	P	E	P	F	E	T	F	CG
SorghXSudan Hyb	P	E	P	F	E	T	F	CG
Foxtail/German Millet	P	G	F	F	E	T	F	
Other								
Rape and Turnips	E	F	F	F	G	S	G	P
Chicory	F	F	F	G	G	S	G	

***Growth Habit**: T = Tall; M = Moderate; S = Short

****Anti-quality components:**

A Alkaloids (decrease palatability)
B Bloat potential (Bloat potential of Kura clover is unknown)
C Coumarin (hemorrhagic agent, formed during spoilage of hay)
CG Cyanogenic Glycosides (may form hydrogen cyanide-HCN poisoning; also Prussic Acid Poisoning)
ET Endophyte Toxicity (reduce blood circulation to appendages "dry gangrene") (variety dependent)
G Glycosides (decrease palatability)
P Photosensitization (sunburn on animals with light colored hair, reduce animal performance)
T Tannins (decrease palatability)

1. Select erect varieties for hay and prostrate varieties for pasture.
2. Limited to extreme southern Iowa, must be allowed to mature and reseed a stand for the next year.
3. Select the more winterhardy varieties for use in Iowa.
4. Select the low-alkaloid varieties to improve palatability.
5. Select the endophyte-free varieties to improve animal performance.

Table 4 may be useful for those who want to modify, alter, or design their own seeding mixture. Mixtures are usually composed to provide about 50 to 75 seeds per square foot. With a seeding year stand count goal of 10 to 20 plants per square foot, this may seem like a high number of seeds to plant. However, seedling death rates are surprisingly high (40-60 percent) because of a wide variety of seeding and seedbed conditions, primarily moisture- and disease-related. Timely planting, careful attention to good seeding technique and using high quality seed are the best management strategies for improving seedling survival rates.

Table 5 provides a list of the most frequently used forage seed mixtures in Iowa. It contains mixtures for specific use situations and those most appropriate for sites where soil drainage or other characteristics may limit success.

With each type of grass or legume different varieties are available, each of which has slightly different traits. A good variety should:
· be a top yielder,
· have sufficient winter-hardiness for your location, and
· be resistant to the array of plant diseases present in your fields.

Iowa State University Extension publishes an annual Alfalfa Variety Test report. However, information about variety performance of forage grasses and miscellaneous legumes becomes available irregularly as output from ongoing grass and legume breeding research is published.

Table 3. Key for Selecting the "Best" Legumes to Plant on Hay and Pasture Lands Differing in Soil Drainage, Fertility, and Ph Level.

Drainage Condition	Fertility Level	pH Level	Adapted Legumes (most to least desirable*)
Good Drainage	High Fertility	pH above 6.5	Alfalfa, Red clover, Trefoil, Ladino clover
		pH below 6.5	Red clover, Trefoil, Ladino or white clover
	Moderate Fertility	pH above 6.5	Alfalfa, Red clover, Trefoil, Ladino clover
		pH below 6.5	Red clover, Trefoil, Ladino or white clover
	Low Fertility	pH above 6.5	Red clover, Trefoil, Ladino clover
		pH below 6.5	Red clover, Trefoil, Ladino clover, Lespedeza*
Moderate Drainage	High Fertility	pH above 6.5	Alfalfa, Red clover, Trefoil, Ladino clover
		pH below 6.5	Red clover, Trefoil, Ladino clover, Lespedeza*
	Moderate Fertility	pH above 6.5	Alfalfa, Trefoil, Red clover, Ladino clover
		pH below 6.5	Red clover, Trefoil, Ladino clover, Lespedeza*
	Low Fertility	pH above 6.5	Red clover, Trefoil, Ladino clover, Lespedeza*
		pH below 6.5	Trefoil, Ladino clover, Lespedeza*
Poor Drainage	High Fertility	pH above 6.5	Red clover, Trefoil, Ladino clover
		pH below 6.5	Red clover, Trefoil, Ladino clover, Lespedeza*
	Moderate Fertility	ph above 6.5	Red clover, Trefoil, Ladino clover
		pH below 6.5	Trefoil, Ladino clover, Lespedeza*
	Low Fertility	pH above 6.5	Alsike clover, Trefoil, white clover, Lespedeza
		pH below 6.5	Alsike clover, Trefoil, white clover, Lespedeza

* Lespedeza is generally adapted only to the lower few tiers of counties in Iowa.

Table 4. Weight per Bushel, Seeds per Pound, Seeds per Square Foot, and Seeding Rate.

Forage Crop	Legal wt per bu (lb)	Seeds per lb	Seeds/sq ft. at 1 lb/A	Seeding rate lb/A[a] Alone	In mixture
Legumes					
Alfalfa	60	225,000	5.0	10-15	4-12
Alsike clover	60	690,000	15.8	4-6 b	1-4
Birdsfoot trefoil	60	380,000	8.7	5-8	2-5
Cicer milkvetch	60	135,000	3.1	20-25	10-15
Crownvetch	60	120,000	2.8	8-15	5-10
Hairy vetch	60	20,000	0.5	20-30	10-20
Kura clover	-	-	5-6	8-10	-
Lespedeza (Korean)	40	235,000	5.4	20-25 c	10-15
Ladino clover	60	800,000	18.4	1-3 b	1/4-1
Mammoth red clover	60	295,000	6.8	8-10	4-8
Medium red clover	60	275,000	6.3	8-12	4-8
Sweetclover	60	260,000	6.0	8-15 c	4-8
Grasses					
Kentucky bluegrass	14	2,177,000	50.0	5-10	2-6
Orchardgrass	14	654,000	15.0	8-12	4-6
Perennial ryegrass	--	275,000	6.3	15-20	5-10
Redtop	14	4,990,000	114.6	3-6 b	1-3
Reed canarygrass	46	530,000	12.2	8-12	4-8
Smooth bromegrass	14	136,000	3.1	10-15	4-10
Tall fescue	25	227,000	5.2	8-15	4-8
Timothy	45	1,200,000	27.5	4-8	2-4
Big bluestem		165,000	3.8	10-12 d	5-6
Indiangrass		175,000	4.0	10-12 d	5-6
Switchgrass		389,000	8.9	5-7 d	3-4
Millets		variable	---	20-40	
Sudangrass	32	variable	---	25-30	

a Use pounds of bulk seed unless specified otherwise.
b Not recommended as a pure stand.
c Use scarified seed.
d Pounds of pure live seed (PLS). PLS%=(% Germination X % Purity)/100

Table 5. Forage seed Mixture Recommendations (lbs. per acre) Hay crops —

Moderately to well-drained, limed or nonacid, fertile soils

1. Alfalfa	12-15	2. Red clover	10-12
3. Alfalfa plus	8-10	4. Red clover or Kura clover	8-10
Smooth bromegrass	6-8	Smooth bromegrass	5-6
or		Orchardgrass	3-4
Orchardgrass	4-6	or	
or		Timothy	3-4
Reed canarygrass	6-8		
or			
Timothy	3-4		

Imperfectly drained, slightly acid soils

5. Alfalfa	5-6	6. Red clover plus	6-8
Red clover	3-4	Smooth bromegrass	6-8
Smooth bromegrass	6-8	or	
or		Orchardgrass	4-6
Orchardgrass	4-6	or	
or		Reed canarygrass	6-8
Reed canarygrass	6-8	or	
or		Timothy	4-5
Timothy	3-4		

Poorly drained soils

7. Red clover	5-7	8. Alsike clover plus	4
Alsike clover	2	Reed canarygrass	6-8
Smooth bromegrass	6-8	or	
or		Timothy	4-5
Reed canarygrass	6-8	or	
or		Tall fescue	6-8
Timothy	3-4	or	
		Red top	4
9. Birdsfoot trefoil	5-6		
Timothy	2-4		

Droughty soils

10. Alfalfa	8-10
Smooth bromegrass	6-8
or	
Orchardgrass	4-6
or	
Tall fescue	6-8

Use Good Seeding Management

Top yields are possible only with thick, vigorous, well-managed stands. Careful attention to seeding practices and seeding year management often makes the difference between profitable, productive stands and failures.

For additional information on forage establishment management, see ISU Extension publications Pm-856, *Improving Pasture by Frost Seeding*; Pm-1008, *Steps to Establish and Maintain Legume-Grass Pastures*; and Pm-1097, *Interseeding and No-Till Pasture Renovation*.

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For Rotation and Permanent Pastures

Moderately to well-drained soils

11. Alfalfa plus	6-8	12. Alfalfa	6-8
Smooth bromegrass	6-8	Timothy	2-4
or		Smooth bromegrass	4-6
Orchardgrass	4-6	or	
or		Orchardgrass	3-4
Tall fescue	6-8		

For mixtures 11 and 12 you can substitute 4 lbs/A red clover for 1/2 the alfalfa seeding rate, or 6-8 lbs/A red clover in place of alfalfa.

13. Smooth bromegrass	15-20		

Imperfectly drained soils

14. Red clover	6-8	15. Ladino clover	1/2-1
Ladino clover	1/2	Orchardgrass	6-8
Orchardgrass	4	or	
or		Smooth bromegrass	8-10
Tall fescue	6-8		
16. Birdsfoot trefoil plus	5	17. Birdsfoot trefoil	6
Smooth bromegrass	6	Kentucky bluegrass	4-6
or			
Timothy	3-4		
18. Smooth bromegrass	15-20	19. Tall fescue	10-15
20. Smooth bromegrass	10	21. Switchgrass	5-7 PLS
Orchardgrass	4		
22. Big bluestem	10-12 PLS		

Poorly drained soils

23. Birdsfoot trefoil plus	5	24. Alsike clover	2-4
Orchardgrass	5	Ladino clover	1/2
or		Reed canarygrass	8
Timothy	3-4	or	
		Timothy	4
		or	
25. Reed canarygrass	10	Tall fescue	8
26. Tall fescue	10-15		
27. Switchgrass	5-7 PLS	28. Ladino clover	1-2
		Kentucky bluegrass	6-8

Droughty soils

29. Alfalfa plus	6-8	30. Smooth bromegrass	15-20
Smooth bromegrass	6-8		
or		31. Tall fescue	10-15
Orchardgrass	4-6		
or		32. Crownvetch	8-10
Tall fescue	6-8	Smooth bromegrass	6-8

Pasture for horses

33. Alfalfa	6-8	34. Ladino clover	1/2
Kentucky bluegrass	2	Kentucky bluegrass	3-5
Smooth bromegrass	6-8	Timothy	2-4
or		or	
Orchardgrass	4-5	Orchardgrass	6
		or	
35. Birdsfoot trefoil	6	Smooth bromegrass	6
Timothy	2		

Pasture for hogs

36. Alfalfa	8	37. Forage Rape	4-6
Ladino clover	2	Oats	1-2 Bu.

Supplemental pasture

38. Sudangrass	25-30	39. Oats	2-3 bu
40. Hybrid Pearl Millet	30-35	41. Winter rye (fall planted)	1 1/2 bu
42. Foxtail/German Millet	20-25	43. Forage Rape	4-6
		Oats	1-2 Bu.

Grassed waterways

44. Reed canarygrass	8-12	45. Tall fescue	10-15
46. Smooth bromegrass	15-25		

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