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Plant Species Selection *Lesson 2*

Introduction

In 1974, H.J. Otto and A.R. Schmid while working for the Agricultural Extension Service at the University of Minnesota produced Agronomy No. 30 Forage Mixtures. They said, "High per acre yield of good quality forage can lower the cost of livestock production and increase profits. Wise choice of forage plants is the first step in successful forage production programs."

Twenty-five years later, that is still the case. The proper selection of plant species is the first step in long-term pasture production. Selecting the appropriate species for specific pastures where they will be grown for their intended use is practical and cost effective. The species mixture should be adapted to the pasture soil and management criteria. Knowing your objectives and criteria for pastures will make the selection much easier.

Producers can be divided into two groups when it comes to species selection. The first group is those who stay with the traditional cool season grasses and legumes species such as smooth bromegrass, timothy and orchardgrass in combination with alfalfa and the clovers. In some cases the new low-alkaloid reed canarygrass and birdsfoot trefoil fit here as well.

The second group is those looking for more variety and experiment with unconventional pasture crops such as chicory, turnips, rape (canola), Kura clover, along with warm season grasses like big bluestem, indiangrass and switchgrass. Each producer will have to determine what best fits his/her livestock and pasture goals.

Renovation

Before ripping up existing pasture or hay ground, consider the potential of the current stand. Evaluation of the current stand is covered in Lesson 1. Review as needed. Probably the most common renovation method is seeding legumes into cool season grass stands. This can increase yield and quality, plus stretch the peak production periods into the summer.

The choice of renovation method will depend on current pasture condition, along with the amount of time and money available for renovation. The choices from most to least aggressive are conventional tillage, reduced tillage, no-till, frost seeding, and livestock seeding, respectively. Generally, as you move from conventional seeding down to livestock seeding, your dependence on mother nature or weather increases.

Selecting Forage Species

Generally forages are divided into four groups: cool-season grasses, warm-season grasses, alternative forages, and legumes. The mix of these will depend on soil type, drainage, pH, fertility, and personal preference. All are capable of successfully producing feed for the grazing animal. Ideally, the production cycle of the forages will match the stage of production of the grazing animals. In other words, maximum forage production and quality should coincide with the herd's maximum nutritional requirements, such as during the calving and breeding season. Appendix A describes the characteristics of different forages, and can be used as a reference for deciding which forages to include in a pasture program. When quality is of concern, legumes provide the highest quality forage followed by cool season annual grasses, cool season perennial grasses, warm season annual grasses, and warm season perennial grasses.

Cool Season Grasses

Cool season grasses produce the majority of their production in the spring, followed by a slump period during the hot summer months and a second growth spurt in the fall. The three most common cool season grasses are smooth bromegrass, timothy and orchard grass. Reed canarygrass has gained a lot of popularity with the new low-alkaloid varieties. Although the natural habitat of reed canarygrass is poorly drained and wet areas, it is as drought tolerant as the other cool-season grasses. In addition, the digestibility of canarygrass is equal to or greater than that of other perenial cool season grasses. Although quackgrass is considered a weed in row crops, lawns, and gardens, some graziers are including it in their pasture mixtures because of its durability and persistence. The endophyte-free tall fescue varieties can be a good cool season choice. Tall fescue forms a dense sod and grows extremely well on poorly drained soils. Tall fescue is well known for active fall growth that remains green after frost, providing high quality, late fall and winter grazing. Tall fescue may not be winter hardy enough for Minnesota. Kentucky bluegrass is generally a low yielding species unless heavily fertilized. Bluegrass has a tendency to become more prominent in pastures that are over-grazed.

Another characteristic of grasses that a producer can take advantage of is the range of maturity of different species, i.e. orchardgrass is much earlier maturing than reed canarygrass. The rationale is similar to planting corn hybrids or soybean varieties with different maturities, they are not all ready to graze at the same time.

Advantages grasses have over legumes include the ability to grow well under less fertile soils and tolerate mismanagement better. Grasses also tolerate livestock trampling better then legumes. A major disadvantage of grasses is the need for nitrogen fertilization if you wish to achieve high yields.

Warm Season Grasses

Warm season grasses have peak production in midsummer, and therefore, work well to even out forage production across summer. Warm season grasses adapted to Minnesota are switchgrass, big bluestem, and indiangrass. Establishment can be slow due to deep root growth the first few years before plant structure develops. Once established they will provide many years of grazing.

Switchgrass can tolerate a wide range of soil conditions, from sand to clay loam, and pH values ranging from 4.9 to 7.6. Switchgrass is the earliest maturing of the warm season perennials. Big bluestem also tolerates a wide range of soils, except for sand ground. Indiangrass is usually the latest maturing of the warm season grasses, flowering about 4-6 weeks later than switchgrass in the same area. Indiangrass may also contain cyanogenic compounds similar to the sorghums, which will be discussed later.

Annual Warm Season Grasses

Annual warm season grasses, such as sorghum/sudangrass and pearl millet, are used to complement cool season pastures, and also may provide a site for manure disposal. Annual warm season grasses often work well as an emergency pasture or hay crop. These grasses have the ability to produce high quality forage during late spring and summer. However, the high cost associated with annual establishment and high fertility requirements may result in higher costs of gain compared to perennial forages. Like other grasses, warm season grasses respond well to N fertilization. However, heavy N fertilization followed by a drought may cause nitrates to accumulate in the forage. If you suspect that your forages may potentially have high levels of nitrates, send a sample of the forage to a laboratory for nitrate analysis. Once the results have been received, consult a nutritionist to see if the forage can be safely fed as is, if it needs to be limited to a certain percentage of the diet (if the forage has been harvested), or would be toxic to the animals. If the forage plant has more then 1.5% nitrate (15,000 ppm), it should be considered toxic to livestock. Properly ensiling forage can potentially reduce nitrate concentration 40 to 60%.

Another potential problem with some of the warm season grasses is prussic acid or cyanide poisoning. Sorghum-sudangrass has the potential to develop toxic levels of prussic acid following drought, frost, or immediately after clipping. It is the fast new growth that is most likely to have high levels of prussic acid. When growth occurs following drought or frost, grazing should be avoided for 14 days. Ensiling dramatically reduces potential cyanide toxicity problems.

Adding Legumes to the Mix

Adding legumes to forage mixtures will often increase forage quality. Legumes, like cool season grasses, have the majority of growth in the spring, but the summer slump is not as drastic. Alfalfa is the most widely used legume where good soil conditions, such as proper drainage and a pH of 6.6 to 7.0, are present. Clovers are generally easy to establish, and can tolerate wetter soils and soils with a lower pH than alfalfa. However, clovers ussually have a short stand life. Birdsfoot trefoil is difficult to establish due to its inability to compete with companion crops, grasses, and weeds. However, with careful management trefoil is an ideal pasture species due to its quality and absence of bloat potential.

The major advantages which legumes have over grasses include the ability to fix nitrogen from the air, higher protein content, higher intake potential, and a slower decline in maturity. However, legumes usually require higher soil fertility, have a lower tolerance to wet soils, and are less persistent than most adapted grasses. Bloat is a concern with most legumes, but bloat incidence can be reduced by including grasses in the mix and proper grazing management.

Lesson 6 of this home study course offers some recommendations for managing animals that are grazing legume pastures.

What kind of mixtures

Mixtures should be kept simple. Keep in mind that you are trying to match forage species with the soil characteristics of a particular field. Persistent species are often not as competitive during the seedling stage as less persistent species. Excessive competition of complex mixtures (more then 4 species) can result in the persistent and desirable species not surviving during the establishment period.

Seeding Rates

Table 1 gives recommendations for seeding rates of legumes, grass and grass-legume mixtures for pastures in Minnesota.

Table 1. Seeding rates for pasture in Minnesota

Species	lbs./ac	Species	lbs./ac
alfalfa	7	red clover	5
with s. bromegrass	10	with s. bromegrass	10
with orchardgrass	4	with orchardgrass	4
with timothy	3	with timothy	3
with reed canarygrass	7	with reed canarygrass	5
with s. bromegrass and orchardgrass	6 3	with s. bromegrass and orchardgrass	6 3
birdsfoot trefoil, pure	8	reed canarygrass	8
birdsfoot trefoil	6	smooth bromegrass	10
with timothy	2	smooth bromegrass with orchardgrass	10 3
with K. bluegrass	*2		
with reed canarygrass	2	switchgrass	5
<u>for sod seeding into grass pasture</u>		big bluestem	10
birdsfoot trefoil	6		
with red clover	2	switchgrass	1
		with big bluestem and indiangrass	5 3
cicer milkvetch	**20-25		
for sod seeding into grass pasture			

*Mixture preferred

**Not recommended for animals with white hair (photo sensitization of animals is expected).

Advantages of Mixtures

Mixtures will provide more uniform seasonal production and are higher yielding than pure stands. The desirable traits of grasses and legumes are combined in mixtures:

- Legumes provide nitrogen for grasses in a mixture.
- Legumes improve forage quality and reduce the potential for nitrate poisoning.
- The fibrous root system of grasses helps in stabilizing slopes and reducing erosion.
- The stand life of forages is lengthened with grasses.
- Grasses reduce bloat potential when included with legumes.
- Grasses compete better with weeds then legumes.

Resources and Reading

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Converting to Pasture or Hay-Forage Seeding Mixtures, Iowa State University, CRP-13/ October 1994

Most of these publications are available through the respective state university.

Iowa State University
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University of Wisconsin
Cooperative Extension Publications
Rm. 245, 30 N. Murray St.
Madison WI 53715-2609
(608) 262-3346

This lesson prepared by:

Jerry Tesmer
Extension Educator, Livestock Systems
112 Main ST. PO Box 310
Preston, MN 55965-0310
(507) 765-3896
jtesmer@extension.umn.edu

Russ Mathison
North Central Research and Outreach Center
1861 E Hwy 169
Grand Rapids, MN 55744
(218) 327-4352
mathison@tc.umn.edu

Forage yield trial information available on the Internet

California
agronomy.ucdavis.edu/alfalfa.wg/subpages/variety.htm

Colorado
www.colostate.edu/Depts/SoilCrop/extension/CropVar/alfalfa/alfalfa1.html

Illinois
www.cropsci.uiuc.edu/vt/forage98/index.html

Indiana:
www.agry.purdue.edu/ext/forages/

Iowa:
www.agron.iastate.edu/icia/

Kansas:
www.ksu.edu/kscpt

Kentucky:
www.uky.edu/Agriculture/Agronomy/files/aboutfvt.htm

Michigan:
www.css.msu.edu/VarietyTrials/Index.html

Minnesota:
www.maes.umn.edu/maespubs/vartrial/vt-cntnt.html

Mississippi:
www.aac.msstate.edu/mafes/Variety/

Montana:
maes.msu.montana.edu/alfalfa97/default.htm

Nebraska:
www.ianr.unl.edu/ianr/agronomy/varitest2.htm

New Mexico:
taipan.nmsu.edu/aght/alfalfa/alfalfa.html

North Dakota:
www.ag.ndsu.nodak.edu/fargo/98data/index.htm

Ohio:
www.ag.ohio-state.edu/~perf

Oklahoma:
clay.agr.okstate.edu/alfalfa/var-test/alf-var.html

Oregon:
http://www.primenet.com/~mesosu/crops/alfalfa.htm

Pennsylvania:
www.cas.psu.edu/docs/casdept/agronomy/forage/docs/species/species.html

South Dakota:
www.sdstate.edu/~wpls/http/forage1.html

Wisconsin:
www.uwex.edu/ces/forage/index.html

Alberta, Canada:
www.agric.gov.ab.ca/agdex/100/2003200k.html

Ontario, Canada:
www.oac.uoguelph.ca/www/CRSC/ofcc/ofcc.htm

APPENDIX A *Characteristics of forages*

Species	Regrowth Potential	Legume Compatibility	Winter Hardiness[a]	Ease of Establishment	Drought Tolerance	Flooding Tolerance	Persistence
Cool-season grasses							
Kentucky bluegrass	Good	Poor	Excellent	Good	Fair	Fair	Good
Orchardgrass	Excellent	Poor	Good	Good	Fair	Fair	Good
Perennial ryegrass	Good	Fair	Poor	Excellent	Fair	Fair	Poor
Quackgrass	Excellent	Good	Excellent	N/A*	Good	Fair	Excellent
Reed canarygrass	Good	Poor	Excellent	Poor	Good	Excellent	Excellent
Smooth bromegrass	Fair	Good	Excellent	Good	Fair	Fair	Good
Tall fescue	Excellent	Good	Fair	Excellent	Fair	Fair	Fair
Timothy	Fair	Good	Excellent	Good	Poor	Poor	Poor
Warm-season grasses							
Big bluestem	Good	Poor	Good	Poor	Excellent	Poor	Good
Sorghum/sudan	Good	Poor	N/A	Excellent	Excellent	Fair	N/A
Switchgrass	Good	Poor	Good	Poor	Excellent	Poor	Good
Alternative forages							
Winter Rye	N/A	Good	Good	Good	Good	Poor	N/A
Oats	N/A	Good	Poor	Good	Good	Poor	N/A
Corn	N/A	Fair	N/A	N/A	N/A	N/A	N/A
Brassicas	Good	Good	N/A	Good	Fair	Poor	N/A

Legumes	Regrowth Potential	Bloat Problem	Winter Hardiness[a]	Ease of Establishment	Drought Tolerance	Flooding Tolerance	Persistence
Alfalfa	Good	yes	Excellent	Good	Good	Poor	Good
Alsike clover	Poor	yes	Good	Excellent	Poor	Good	Poor
Birdsfoot trefoil	Fair	no	Excellent	Poor	Poor	Fair	Excellent
Ladino clover	Poor	yes	Good	Excellent	Poor	Good	Poor
Red clover	Fair	yes	Good	Excellent	Poor	Fair	Fair
Sweet clover	Fair	yes	Good	Fair	Good	Fair	Poor

Source: Pastures for profit

N/A = not applicable

(a)Winter hardiness assumes use of adapted varieties

*No seed available