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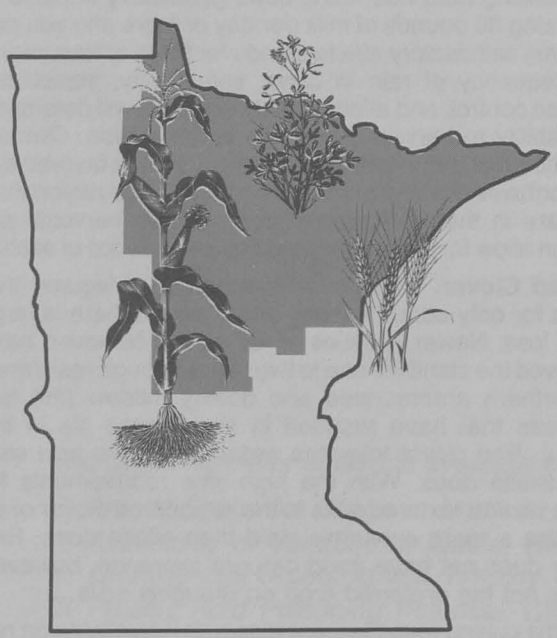
MANAGEMENT OF CROPS AND SOILS
IN NORTH CENTRAL
AND NORTHEASTERN MINNESOTA
CORRESPONDENCE COURSE

Unit 5—Selecting and Managing Forage Crops

Purposes

- Recognize the best forage crop to produce on your soils.
- Recognize the role your management plays in providing desired forage crop production.
- Develop a criterion for selecting perennial forage crops based on plant growth in response to your management practices.
- Recognize how to select varieties of perennial species grown for forage in Minnesota.



Agricultural Extension Service • University of Minnesota

SELECTING FORAGE CROPS

Soils and climatic conditions place general restrictions on the kinds of crops that can be grown profitably. On many northern Minnesota farms, a combination of crop and livestock enterprises maximizes net returns to land, labor, and investment. On these farms the most profitable cropping program is one adapted to the feed requirements of the livestock, balanced with the potential of the cropland to produce the required quantity and quality of feed. Using legumes in crop rotation improves the energy balance of crop production, minimizes soil erosion loss, and maintains high corn yields with lower nitrogen and insecticide needs than is true with continuous corn or continuous cash crops.

Soil drainage is an important factor in yield performance of various crops. Alfalfa should not be grown on wet soils. On imperfectly drained soils, some varieties of alfalfa with resistance to Phytophthora root rot can be grown. Red clover and birdsfoot trefoil are other legumes that will tolerate imperfectly drained soils. On wet soils a cool season perennial grass is best; however, acreage devoted to grasses should not be restricted to wet soils. Producers should be concerned about crop choice on poorly drained soils.

Two basic nutrients for livestock are protein and energy, which are needed in varying amounts by different classes of livestock for production of milk, meat, and wool. Major emphasis in the cropping program must be placed on supplying total energy and protein needs as economically as possible. Growing all feed from homegrown forages remains of great importance to livestock producers in northern Minnesota.

Protein and energy vary between forage crops and generally vary within a species due to stage of maturation at harvest. Northern Minnesota growers use predominantly perennial crops as forages, but corn silage and small grain hay or silage and summer annuals (sorghum-sudangrass, sudangrass, or foxtail millets) also are used. Corn and sorghum-sudangrass produce top dry matter yields and yield the most energy per acre. Alfalfa, alfalfa-grass mixtures, and red clover produce the highest crude protein yields per acre. Perennial cool season grasses fertilized with nitrogen (100-200 pounds actual N) also are high in crude protein. Yield of protein and energy is intermediate with small grain crops grown alone for forage or mixed with a leguminous annual such as field peas. Crop residues such as corn stalks or small grain straw have feeding value but are often low quality forages used in animal maintenance rations as low cost alternate feed sources. Care must be taken not to spend more money harvesting and storing these low quality forages than they are worth as feed.

Corn Silage

The most important factor in growing corn silage successfully is to harvest at physiologic maturity of the grain (maximum dry matter accumulation of the plant). Harvesting at physiological maturity of the grain provides maximum yield of total digestible nutrients, minimum field and storage loss, and maximum daily animal consumption.

When the corn grain reaches physiologic maturity, several layers of cells near the cob tip of the kernel turn black. To look for the black layer, remove a kernel from the middle of an ear and split it lengthwise. If there is a black layer near the tip the grain is mature.

Due to a short frostfree season in northern Minnesota, short relative maturity hybrids (75-day to 85-day from north to south or east to west in the region) provide the best assurance that a hybrid will reach physiologic maturity before killing frost. Fertilize according to your yield goal, use starter fertilizer in early plantings, and select the herbicide or herbicides that provide the best control of your problem weeds. *Remember that more nutrients are removed when corn is harvested for silage than when it is harvested for grain.*

Other Annuals for Forage

When fertilized the same as corn and harvested once per season (close to grain maturity), warm season annual grasses like sorghums and foxtail millets often will equal corn silage dry matter yield. Often, however, they analyze lower than corn silage in digestible energy and dry matter intake potential. Digestible energy and crude protein concentrations in these grasses are higher at immature stages, but total season yield is reduced when they are harvested more than once per season. You should be aware, however, that sorghums may grow very slowly during cool wet years in northern Minnesota, resulting in low yields.

Caution: Sorghums harvested for forage immediately after a killing frost contain toxic concentrations of a compound that results in prussic acid poisoning when fed to ruminant livestock. Delaying harvest of sorghums taller than 18 inches for 3 to 5 days and suncuring after conditioning reduce prussic acid poisoning potential to safe levels for livestock feeding. Foxtail millets do not contain the compounds that cause prussic acid poisoning.

Small grain crops can be harvested for forage as hay or silage. Maximum nutrient yield is reached at the soft dough stage of grain maturity, but silage fermentation often is better when the crop is harvested at head to milk stage and wilted to 60 percent moisture. Palatability of small grain hay also is better at head to milk stage. Barley is superior to oats and spring wheat in crude protein and digestible energy. Unless you are using head chop barley, however, best results are expected from barley as a forage if it is harvested at boot stage (heads in the leaf sheath). Palatability may be reduced when awned heads appear in forage harvested at later maturities. Yield is reduced at boot stage, but if the seedbed can be prepared following harvest for seeding of legumes or grasses by August 1, it provides a double cropping alternative. *Do not, however, summer seed on sandy soils.*

The advantages of a perennial crop such as alfalfa over annual crops exist because with perennials there is less seedbed preparation, less seeding, and no need for N fertilizer. Annual crops, however, have some advantages that make them competitive. In this northern area, annual crops can be grown with fewer amendments such as lime, sulfur, and boron and without the high rates of potassium that are required for successful alfalfa growth. Farmers who have no difficulty growing alfalfa will find it is one of their best crops for overwintering livestock.

Perennial Legumes and Grasses

Stage of maturity at the time of harvest is the most important single factor influencing the feed value of legumes or grass forages. New market standards proposed by the American Forage and Grassland Council identify digestible dry matter intake as an important factor to consider in selecting legumes or grasses. The proposed grade system uses two chemical tests, acid detergent fiber and neutral detergent fiber, to predict intake of digestible dry matter. These standards illustrate that legume forages have a higher intake potential than grasses. High performing ruminants (dairy cows milking 80 pounds per day and finishing steers or heifers and pregnant ewes in the last third of gestation or in early lactation) have high nutrient requirements for digestible dry matter. You should feed these livestock early cut legumes or early cut legume-grass mixtures that contain less than 25 percent grass. More than 25 percent grass in a mixture with a legume will lower the grade one level below that established by the legume in the mixture.

Alfalfa. Grade 1 alfalfa has enough dry matter intake potential to supply sufficient quantities of protein and energy when fed with corn grain to support the production of 80 pounds of milk per day. Therefore, an examination of management considerations to grow grade 1 alfalfa should be considered. The cutting schedule most likely to result in the most grade 1 alfalfa is first cut at bud stage, second cut 30-35 days after the first, and third cut at one-tenth bloom or late in the fall. Yield reductions will occur if you cut for grade 1 on all cuts. These reductions can be justified only if your milking herd has many cows genetically capable of producing 80 pounds of milk per day or more and you can maintain satisfactory alfalfa stands for three or four years.

Frequency of rain in June, soil fertility, insect and disease control, and alfalfa variety selection will determine your ability to harvest three cuts in this region. Climatic conditions for three cuttings of alfalfa are more favorable in the northwestern and southern portions of the region than they are in the northeastern portion. Two harvests per season allow for maximum yield and persistence of alfalfa.

Red Clover. Red clover is a perennial legume that grows for only about two hay years before there is large stand loss. Newer varieties of red clover, however, have improved the stand life one to two years through resistance to Northern anthracnose and downy mildew (the two diseases that have resulted in short stand life in the region). Red clover tolerates wetter and more acid soils than alfalfa does. With the high lime requirements for alfalfa on fine textured soils in the region, red clover often provides a more economic yield than alfalfa does. Red clover does not have good drought tolerance, however, and is not the preferred crop on droughty soils.

Little cutting management research is available on red clover. At similar stages of maturity, red clover is equal to alfalfa in crude protein concentration and higher in di-

gestible energy concentration. We do not think that red clover will tolerate as frequent a cutting schedule as alfalfa without significant reductions in yield and persistence. Red clover does not require the quantity and number of nutrients that alfalfa does, but its winterhardiness is slightly less than that of alfalfa.

Cool Season Grasses. Cool season perennial grasses such as smooth bromegrass, reed canarygrass, timothy, orchardgrass, and quackgrass perform better than Kentucky bluegrass under harvest management in this region. Any of these species of grass will equal the yield and crude protein concentration of alfalfa when they are fertilized with 100 to 150 pounds per acre of actual N (200 to 300 pounds per acre of urea). Higher rates of N, although probably not economical, will result in yields higher than those for alfalfa when rainfall is not limiting.

Cool season grasses are categorized as bunch or sod-forming. Bunch grasses (timothy, orchardgrass, and tall fescue) produce tillers from basal stem buds that grow within the leaf sheath and develop new aboveground growth. Sod-formers (smooth bromegrass, reed canarygrass, and quackgrass) have many tillers initiated from basal stems that break out of a leaf sheath to form horizontal stems or rhizomes (stems growing below ground). A shoot is initiated for top growth at various buds along a rhizome.

In general, sod-formers are slower to recover after cutting and more winterhardy than are bunch grasses. *Bunch grasses that recover rapidly after cutting offer better yields and persist better than sod-formers under a frequent cutting system.*

Except for timothy, all the grasses mentioned here must overwinter before they can produce seed. Cool season grasses produce many tillers during late summer and early fall. After these tillers have been subjected to cold temperatures and short days (winter conditions) they are capable of developing to produce seeds. This explains why few seed heads are produced in second and third cuttings of smooth bromegrass, orchardgrass, quackgrass, or reed canarygrass. If the first cut occurs early enough so that not all tillers that overwintered have elongated to produce stems, some heads will appear in the second cutting. Timothy grass can produce seed heads for each cut.

Economic Considerations for Crops for Forage

Selecting forage crops in these regions is difficult because you have many choices and because you must assess the economics of each choice. Economic considerations are confusing because a perennial often is an alternative. Perennials normally do not return substantial income until the year after establishment, so you must develop the costs and the return dollars over the expected stand life. You must therefore assess the economics of perennials as a cost and return figure prorated for the life of a stand. Tabulate costs for the seeding year and each production year and divide by the number of total years, including the establishment year. This figure is the prorated annual production cost, which can be compared to annual forage crop production costs.

MANAGING PERENNIAL FORAGE CROPS

Pure Stands

Seeding pure stands of alfalfa, red clover, orchardgrass, or other perennials has gained popularity in recent years. Pure stands of legumes such as alfalfa, red clover, and birdsfoot trefoil are used because preplant incorporated herbicides used with direct seeding kill grasses. Thus, pure stands allow for better management during establishment and allow for timely cutting, fertilization, and insect, disease, and weed control. Pure legume stands also provide forage of higher intake potential than do forages containing grass. All legume stands require longer drying time, are invaded by grasses, and, in the case of alfalfa, require more annual fertilizer than do other perennial crops.

Using pure stands of perennials of varying maturities can allow harvest of more species at the optimum state of maturity.

If it takes three weeks to harvest all your forage acreage, spreading maturities out over the period allows a chance for more of each forage to be high in quality when harvested than if all forage matures at once. Perennial species mature in this order: orchardgrass, smooth bromegrass, reed canarygrass, alfalfa, timothy, red clover, and birdsfood trefoil. On first cutting, varieties of orchardgrass and timothy also will vary in length of maturity. Alfalfa varieties vary in rate of maturation only when temperatures are warm during the second or third cuttings. In terms of maturity, it is easier (in this growing region) to obtain three cuttings per season of an early maturing variety of orchardgrass than of a later maturing variety of timothy or even alfalfa. With only a 33 percent probability of obtaining three consecutive dry days in June in northern Minnesota, there is an added incentive to spreading out optimum cutting dates.

Legume Grass Mixtures

Grasses often are added to legumes at seeding to: (1) speed up drying time, (2) extend the stand life of a pure legume stand, (3) reduce the incidence of bloat with legumes that have bloat potential, (4) improve soil conservation, and (5) reduce the invasion of weeds. The amount of grass required to accomplish these intentions varies. Twenty-five percent grass (a visual estimation of composition of the forage mixture) in a legume-grass mixture will meet the needs of all items except reduction of incidence of bloat. *Bloat incidence is only reduced when at least half the mixture is grass.*

Excellent management is required to maintain the desired mix of grasses and legumes. The amount of grass in a mixture is influenced by seeding rate, number and frequency of cuttings per season, fertilization and manure application, and degree of winter damage. Herbicides that control broadleaf weeds or grasses selectively cannot be used in mixtures. It is difficult to harvest at the optimum stage of maturity for all components of the mixture, although some species are compatible. Grasses that closely match alfalfa in maturity are orchardgrass (only late-maturing varieties), smooth bromegrass, reed canary-

Selecting and Managing Forage Crops

Please fill out and return

Name_____

Address_____ County_____

1. List the crops you use for forage on your farm.

2. List those crops that have not performed as well as you expected and indicate what practice or practices might have caused poor performance.

3. What do you plan to change in your forage crop program to eliminate the poor performance you have experienced? What are your new expectations?

4. Have you shifted acreage of annual or perennial crops? Tell why you made this shift.

over

5. List the varieties of perennial forage crop species you grow. Have you decided to try any new varieties?(_____Yes _____No) If you have, indicate which varieties you will be trying and why.

6. Please list any questions you have about selecting or managing forage crops.

The following material also is available on request. Please check those you would like to receive.

- ☐ *Annual Crops for Silage in Northern Minnesota,* Miscellaneous Report 117
- ☐ *Availability of Varieties of Alfalfa, Red Clover, Birdsfoot Trefoil, Reed Canarygrass, Smooth Bromegrass, Orchardgrass, Timothy, and Tall Fescue Available in Minnesota,* Crop News No. 42
- ☐ *Prussic Acid Poisoning Potential,* Crop News No. 52
- ☐ *Varietal Trials of Farm Crops,* Miscellaneous Report 24
- ☐ *Insect Control of Forage Crops,* Entomology Fact Sheet 4

grass, and timothy (only early maturing varieties). Only late maturing varieties of timothy match closely with red clover and birdsfoot trefoil.

Fertilizing Perennial Forages

Perennial forages require large quantities of nutrients for high yields. Yield often is limited by nutrient supply. Remember that alfalfa is a heavy user of phosphorus, potassium, sulfur, and boron. Grasses require high amounts of N for optimum yields and often require an N application before each harvest.

Fertilize legume-grass mixtures that have 35 percent or more legume as a pure legume. Mixtures of less than 35 percent should be fertilized as a grass. Annual applications of nutrients in legume-grass mixtures are more critical in mixtures than in pure stands because the fibrous shallow root systems of grasses compete for the surface nutrients taken up by alfalfa crowns.

Variety Selection

Selecting varieties of smooth bromegrass, orchardgrass, tall fescue, and timothy should be based on yields from university trials. Additionally, orchardgrass and timothy selection should be based on the desired length of maturity. You can find this information in Miscellaneous Report 24, *Varietal Trials of Farm Crops.*

Alfalfa. Select a moderately winterhardy alfalfa with high levels of bacterial wilt resistance that yields at least two percent above Vernal for this region. On soils classified as imperfectly drained or in fields in which Phytophthora root rot has been identified, select a variety with at least 20 percent resistance to this disease. Select high yielding varieties from North Central Agricultural Experiment Station (Grand Rapids) tests to be evaluated on your farm. Use yield, leaf disease incidence, and persistence to select superior varieties for your farm.

Red Clover. Select varieties of medium red clover that have the highest yields in the third production season. New varieties have been selected for resistance to Northern anthracnose and downy mildew. When purchasing red clover seed, be sure to check that it is one of these long lived clovers.

Glossary of Terms

Annual crop: Crop that is planted and harvested the same year.

Bacterial wilt: A prominent disease of alfalfa. Microscopic organisms that cannot manufacture their own food enter alfalfa roots through wounds and grow in the vascular tissue (cells that transfer water to aboveground plant parts) and interrupt uptake of water. This disease affects stands two to three years old or older.

Bunch type grass: Grasses that produce upright growing tillers from many basal stem buds, resulting in clumps of grasses. Examples are orchardgrass, timothy, and tall fescue.

Cereal forage: Grain crop harvested when immature for hay, silage, or green chop.

Cool season grass: Grass species adapted to rapid growth during the cool moist periods of the year; usually dormant during hot weather or injured by it.

Corm: Bulblike short fleshy solid stem found at the base of timothy stem.

Northern anthracnose: A disease found in red clover grown in northern latitudes. It is caused by a fungus that builds up just before first and second harvests. Plants of susceptible strains lose many leaves and eventually die, causing red clover stand loss.

Physiologic maturity: Stage of development in corn at which maximum dry weight is accumulated and growth stops.

Pytophthora root rot: A disease that occurs in nearly every area of the world where alfalfa is grown and is especially severe in regions where soils remain waterlogged for 10 days or longer. The disease is devastating in seedling stands but also can cause severe stand loss in older stands.

Prussic acid poisoning: Sorghums contain a chemical compound which, when cells are ruptured (due to hail, frost, or trampling), releases hydrocyanic acid (HCN). HCN is attached to methemoglobin in the blood instead of to oxygen, causing animals to suffer from lack of oxygen and possibly die.

Sod former: Cool season grasses that form horizontal tillers from base stem buds. Examples are smooth bromegrass, reed canarygrass, Kentucky bluegrass, and quackgrass.

Warm season annual: An annual grass species that does most of its growing during the warm part of the year.

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