Forage quality means different things to different people. Forage quality varies tremendously among and within forage crops. Forage quality needs varies among and within animal species. Forage quality has been defined in terms of protein, fiber, lignin content, relative feed value, relative forage quality, color, smell, leafiness, fineness of stems, total digestible nutrients, and other physical and/or chemical components. All of these components have merit, but all fall short of clearly defining forage quality. Factors such as average daily gains, conception rates, milk production, wool production, etc. are reliable indicators of forage quality. Forage quality can be defined as: the extent to which a forage (pasture, hay, silage) has the ability to produce a desired animal response. With this working definition we realize that we must consider the animal. As an example, a high producing dairy cow needs a higher quality feed than a dry pregnant beef cow. A basic principle in efficient livestock production is to know forage quality and match that quality to animals needs.

Factors Affecting Forage Quality

Animal Considerations - The ultimate test of forage quality is animal performance. Quality can be considered satisfactory when animals give the desired level of performance. Factors which influence animal performance include: 1) Palatability - Will the animals eat it? In general, high quality forages are highly palatable and vice versa. Animal selection of one forage species over another depends on smell, touch and taste. Palatability may be affected by texture, leafiness, fertilization, dung and/or urine patches, moisture content, pest infestation, or compounds that cause a forage to be sweet, sour, or salty. 2) Intake - How much will they eat? Forage must be palatable if it is to be consumed in adequate quantities to meet animal needs. In general, the higher the quality, the more that will be consumed. 3) Digestibility - Of the forage consumed, how much will be digested? Once the forage is consumed, it must be digested to be converted to animal products. Digestibility (the portion of the forage consumed in passage through the alimentary tract) varies greatly, depending on the type of material consumed by the animal. Immature, leafy grasses may be 80 to 90 percent digested, while digestibility of mature stemmy material is often below 50 percent. 4) Nutrient content - Once digested, does the forage provide an adequate level of nutrients? Leafy growing forage plants usually contain 70 to 90 percent water. With this variation, it is best to express forage yield and nutrient content on a dry matter basis. The constituents of forages can be divided into two main categories: a) those present as cell contents or the non-structural part of the plant tissue (protein, sugar, and starch); and b) those which make up the structural components of the cell wall.
(cellulose, hemicellulose, and lignin). High quality forages are high in protein, energy, vitamins and minerals and low in fiber and lignin. 5) **Anti-quality factors** - Depending on the plant species, time of year, environmental conditions, and animal sensitivity, various compounds can reduce animal performance, cause sickness, or ultimately death of the animal. Included in this group of compounds are: tannins, nitrates, alkaloids, cyanoglycosides, estrogens, mycotoxins, and other unidentified constituents. High quality forages must be free of anti-quality factors which are harmful to animals consuming it.

**Plant Considerations**

Many factors affect quality of the forage crops we grow for pasture, hay, or silage including: species, varieties, fertility, pest damage, growing conditions, harvest and storage techniques, grazing management, plant age, stage of maturity, and climate and weather changes. Of the above factors, species and stage of maturity usually offer the greatest opportunity to improve forage quality the most.

**Plant Species** - Considerable variation exists in quality among and within forage species. In general, legumes are higher in quality than grasses. Cool season grasses are generally more digestible than warm season grasses. Cool season annual grasses are usually more digestible than cool season perennial species at the same stage of maturity. Considerable variation also exists among varieties within species. Plant breeders have improved, and continue to improve forage quality within species.

**Stage of Maturity** - Of all the factors affecting forage quality consumed as pasture, hay or silage, stage of maturity when harvested is the most important and the one in which greatest progress can be made. As legumes and grasses advance from the vegetative (leafy) to the reproductive (seed) stage, they become higher in fiber and lignin content and lower in protein content, digestibility, and acceptability to livestock. Grasses may have a protein content of over 30 percent when in an immature leafy stage but drop to less than 8 percent when mature. Digestibility drops with age in both grasses and legumes and may decline at rates of over 0.5 percent per day. Relative Feed Value in alfalfa can drop by five points per day as it advances from the bud stage. Over the past twenty years in Wisconsin, quality tested hay auctions each increase in Relative Feed Value was worth $10.86 to the seller. The optimum stage for harvesting forage crops for hay or silage is always a compromise among yield, quality, and stand persistence. In general, the best compromise position for first harvest is when the plants are changing from the vegetative to reproductive stage. In grasses it represents the boot to early head stage; in legumes bud to early flower.

**Summary**

Efficient livestock producers must produce high forage yields, but additional emphasis must be placed on quality. Producing high quality forage requires attention to
details from pre-establishment to post-harvest. It is not necessary to understand how forage quality is measured in a laboratory, but some understanding of how forage quality affects animal performance is important to efficient livestock production. We need to know the quality of feed available either as pasture, hay or silage and the nutritional needs of the animals we are feeding. Knowing this we can match feed based on quality to animal based on requirements. We need to realize the impact plant species and stage of maturity have on forage quality and animal performance. It is the total quantity of available nutrients in a given amount of forage, and not the total quantity of forage, that is of primary importance in obtaining good animal performance.

Selected References


