

Biologically Efficient 12-Month Pasture and Harvested Forage Management Strategies for Range Cows

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Llewellyn L. Manske PhD
Range Scientist
North Dakota State University
Dickinson Research Extension Center

Biologically efficient 12-month livestock forage management strategies improve profit margins for beef production and enhance the regional agricultural economy by increasing value captured from land natural resources.

Major efforts of the beef production industry at correcting the problems of high production costs and low profit margins have been on improving animal performance. Complex tools and techniques have been developed for beef producers to evaluate individual animal performance and to predict future performance. As a result, the North American beef herd has been transformed into high-performance, fast-growing meat animals with improved genetic potential and increased nutrient demands. Modern, high-performance cattle are larger and heavier, gain weight more rapidly, produce more milk, and deposit less fat on their bodies than old-style cattle. After 40 to 50 years of improvements in animal performance, high production costs and low profit margins continue to be problems for the beef production industry.

These problems persist as a result of the mismatch of forage nutrients required and forage nutrients available between modern, high-performance cattle and traditional low-performance old-style livestock forage management practices. Forage management systems were not improved simultaneously with beef cow performance. Traditional forage management practices are antagonistic to plant growth mechanisms and ecosystem processes, inefficient at nutrient capture and conversion, and deficient at providing adequate forage quality for modern livestock at low cost.

The beef production industry is intrinsically resistant to accepting and making changes to these traditional forage management practices. Beef producers tenaciously perpetuate the use of the same basic concepts and technologies of pasture and harvested forage management that were developed by their forefathers during the early stages of the beef industry for the old-style low-performance cattle. Most beef producers follow traditional management principles unquestioningly and do not know if a particular pasture or harvested forage management

practice used on a specific parcel of land yields an income or is an expense. Beef production is the last meat industry to evaluate feed costs and to make feed management decisions from the cost per unit of dry matter. The swine, poultry, and dairy industries have switched to efficient feed management systems that evaluate feed costs from the cost per unit of the nutrients.

Traditional livestock forage management practices assume the source of income to be from the sale of the animals. Pasture forage and harvested forage, and labor and equipment are considered to be costs of production. Profits result when the sale value of livestock weight is greater than the paid production costs. Reduction of livestock production costs requires reduction of the labor and equipment costs, and the pasture forage and harvested forage costs. Efforts at reducing the high production costs tend to use feeds with low forage dry matter costs and low nutrient content. Traditional beef cow forage feed rations are deficient in crude protein for 29% to 45% of the days per year. Modern cattle on traditional forage management practices developed for old-style cattle have reduced production efficiencies that depress cow and calf weight performance below genetic potentials causing reduced value received at market and reduced profits.

Traditional forage management concepts that consider livestock weight as the source of income inhibit, and often prohibit, using the land resources and the labor and equipment resources efficiently to the detriment of livestock production. The land resources that produce pasture forage and harvested forage and the labor and equipment resources that perform the work are essential components of forage management strategies and these resources need to be used efficiently for livestock production to be profitable.

Efficient forage management concepts that consider the land natural resources as the source of new wealth generated by livestock agriculture and regard the renewable forage plant nutrients as the primary unit of production that are converted into animal weight commodities and then sold at market

provide an almost unlimited combination of possibilities for efficient resource use that result in widening the margins between production costs and market value of the produced commodities. Production from the land resources, production from the livestock resources, and production by the labor and equipment resources all contribute to the production of saleable commodities. Profits result when the costs of the resource inputs are lower than the market value of the resulting commodities produced. Profits increase with increased biological efficiencies of resource use.

Evaluation of the efficiencies of livestock forage management strategies is complicated because the various pasture forage types and harvested forage types have complex differences. The quantitative values for land rent costs, equipment and labor costs, seed costs, production costs per acre, and forage dry matter costs influence livestock feed costs but do not directly regulate forage feed costs because variations of these production costs are not proportional with the forage dry matter weight per acre and do not respond proportionally to the variations in quantities of nutrients contained within the dry matter.

The quantitative values for crude protein costs per pound, calf weight gain costs per pound, and forage feed costs per day directly affect livestock feed costs and are the three most important factors with diagnostic value in selection of low cost forage types. The quantitative values for size of land area per cow-calf pair, and returns after feed costs per acre are the two most important factors with diagnostic value in identification of forage types that efficiently capture value from the land natural resources.

The fundamental problem with traditional livestock forage management concepts is that the land resources are managed from the perspective of their use. Management for a use narrowly considers only the few elements directly related with the specific portions of the resource expended and neglects to address the needs of the other individual components that makeup the ecosystems. The renewable natural resources (rangelands, grasslands, croplands, forestlands, and fisheries) have all been managed traditionally for their use. Rangelands are touted to be managed for multiple uses. These renewable resources are no longer able to maintain current production at potential levels as a result of the management caused declining ecosystem processes. Small cities and towns that depend on farming, grazing, logging, and fishing for their economic base are declining in a symptomatic response to the decrease in resource productivity.

Renewable natural resources are complex ecosystems with several trophic layers of living organisms that have individual biological requirements and nonliving components that have changeable characteristics. It is imperative for future progress that management of renewable natural resources be directed away from placing priority on the use and to be focused towards meeting the requirements of all the living and nonliving components of the ecosystems for the purpose of improving ecosystem processes and maintaining production at sustainable levels. In order to achieve continued ecosystem production of new wealth at potential sustainable levels, the rangeland, grassland, and cropland renewable natural resources require that livestock forage management strategies focus on the critical components and meet the biological requirements of the plants and soil organisms, and foster the characteristics of the soil and the biogeochemical processes. The desired increase in profits can be achieved by objective evaluation and development of improved biologically efficient 12-month pasture and harvested forage management strategies with low cost forage that meets daily nutritional quality for high-performance beef cattle.

The renewable forage plant nutrients produced on the land natural resources are the original source of new wealth generated by livestock agriculture. The maximum quantity of wealth produced on the land natural resources is limited only by the biological capacity of the plants to produce herbage and nutrients from soil, sunlight, water, and carbon dioxide. The nutrients produced by forage plants are the primary power driving all ecosystem functions and the origin of all secondary production by wildlife and livestock. The quantity of new wealth generated by livestock agriculture from forage nutrients produced on the land resources is proportional to the forage management strategies' capabilities to be effective at meeting the biological requirements of the plants and soil organisms, to be efficient at capturing produced forage nutrients, and to be efficient at converting forage nutrients into salable commodities like calf weight.

Effectively meeting the biological requirements of plants and soil organisms occurs when the defoliation resistance mechanisms of grass plants and the biogeochemical processes of grassland ecosystems are activated by partial defoliation during phenological growth between the three and a half new leaf stage and the flowering (anthesis) stage. These mechanisms and processes help grass tillers withstand and recover from grazing by triggering compensatory physiological processes that increase growth rates,

increase photosynthetic capacity, and increase allocation of carbon and nitrogen; by stimulating vegetative reproduction of secondary tillers from axillary buds; and by stimulating rhizosphere organism activity and increasing conversion of inorganic nitrogen from soil organic nitrogen. Activation of these mechanisms and processes result in increased herbage biomass production, increased plant density, increased available forage nutrients, increased soil aggregation, improved soil quality, increased soil water holding capacity, increased resistance to drought conditions, improved wildlife habitat, and improved grassland ecosystem health status.

Efficient forage nutrient capture occurs when a high proportion of the forage produced nutrient weight is harvested by grazing or haying. Forage nutrients are the valuable unit of production from grazinglands and haylands. The greater the weight of forage nutrients captured per acre, the greater the new wealth generated by livestock agriculture per acre. Forage nutrient weight per acre changes during the growing season and is related to the percent nutrient content of forage and to the weight of forage dry matter at the time of harvest by grazing or haying. The optimum plant growth stage for harvest is that at which the herbage production curve and the nutrient quality curve for a specific forage type yield the greatest nutrient weight per acre.

A pound of crude protein has a greater impact on the natural resources of an ecosystem to produce and a greater influence on the cost of livestock forage feed than the production of a pound of energy (TDN). The greatest weight of crude protein per acre does not occur at the peak percent crude protein or at the peak dry matter weight per acre. The phenological growth stage with the greatest pounds of crude protein per acre for perennial grasses and annual cereal grasses is the flowering growth stage. High quantities of crude protein are captured by haying when grasses are cut early, between the boot stage and the early milk stage. Increased capture of crude protein from grasses by grazing requires stimulation of vegetative secondary tillers and partial defoliation of both the lead tillers and the secondary tillers during phenological growth between the three and a half new leaf stage and the flowering stage, respectively. The growth stage with the greatest pounds of crude protein per acre for legume forages is when the plants are at full growth but before the leaves start drying from senescence. High quantities of crude protein are captured by haying when legumes are cut one time during a late full-growth stage.

Efficient forage nutrient conversion into animal weight commodities occurs when nutrients are provided at the times and in the amounts required by livestock. Beef cow nutrient requirements change with the change in production periods. The forage nutrients available to the cattle from the forage types or combination of forage types should be changed to match the change in nutrient requirements.

Modern beef cattle do not deposit body fat to the extent of the old-style cattle. Short periods of nutrient deficiency drain body fat stores causing weight loss and reductions in milk production resulting in calf weight gains and calf weaning weights at below genetic potentials. Animal weight performance at below genetic potentials is inefficient conversion of forage nutrients and is high cost. Efficient 12-month forage management strategies select appropriate combinations of pasture forage types and harvested forage types so the herbage production curves and the nutrient quality curves of the forages supply the forage and nutrient quantities that match the dietary forage quantity and nutrient quality required by beef cattle during each period of the annual production cycle.

Improvement in performance of forage management systems requires paradigm shifts that consider the land natural resources to be the source of new wealth generated from livestock agriculture with the renewable forage nutrients as the primary unit of production and the produced animal weight as the commodity sold at market. Biologically efficient 12-month pasture and harvested forage management strategies effectively meet the biological requirements of plants and soil organisms, and improve the characteristics of soil; efficiently capture forage produced nutrients; and efficiently convert nutrients into animal weight commodities. These improvements permit renewable natural resource ecosystems to perform at biologically sustainable levels and modern high-performance beef cattle to perform at genetic potentials. Results of these improvements reduce costs per pound of crude protein, reduce costs per pound of calf weight gain, reduce costs per day of forage feed, and increase returns after feed costs per acre. These changes in costs and returns effectively increase profit margins for land and cattle enterprises and improve regional economies based on livestock agriculture.

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