Dining Out: Principles of Range Cattle Nutrition

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ANIMAL PERFORMANCE ON SAGEBRUSH-STEPPE RANGELANDS

Range cattle production in the sagebrush steppe, as elsewhere, depends upon the quality of consumed forage plants. The ultimate criterion of forage quality is measured in terms of animal performance. Figure 1 demonstrates gains of suckling calves and yearling cattle on the Northern Great Basin Experimental Range averaged over several years during the grazing season (Raleigh and Wallace 1965). Gains by yearlings are typically 2.0 pounds from late May through June; 1.5 pounds or less during July; and less than 1.0 pound thereafter (Turner and DelCurto 1991). Gains by suckling calves left with cows vary from 1.75 - 2.0 pounds during May and June; then decline to 1.5 pounds or less in July; less than 1.0 pound in August; and fall to less than 0.5 pound in September.

Typical weight changes of lactating beef cows on sagebrush-bunchgrass range are shown in Figure 2 (Turner and DelCurto 1991). Gains may exceed 4.0 pounds per day during May and June, but rapidly decline during late June and July. Spring-calving cows will gain less and lose more weight than cows that calve in the fall because of the demands of the suckling calf.

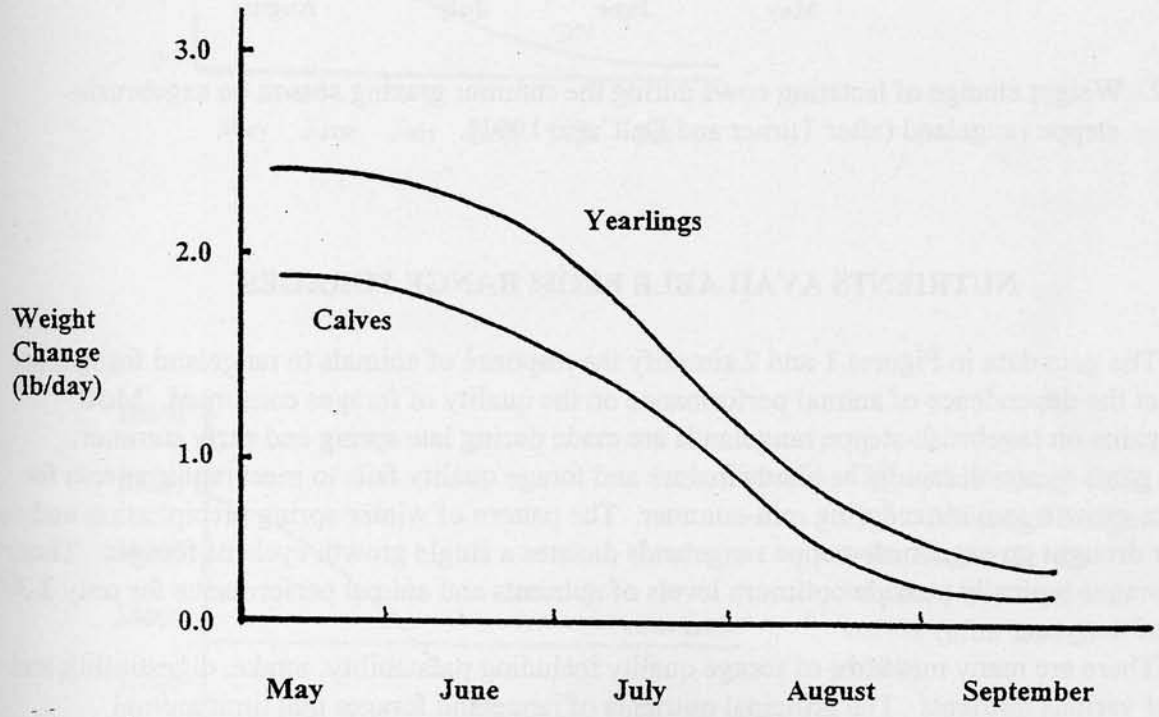

Figure 1. Weight change of suckling calves and yearling cattle during the summer grazing season on sagebrush-steppe rangeland (after Raleigh and Wallace 1965).

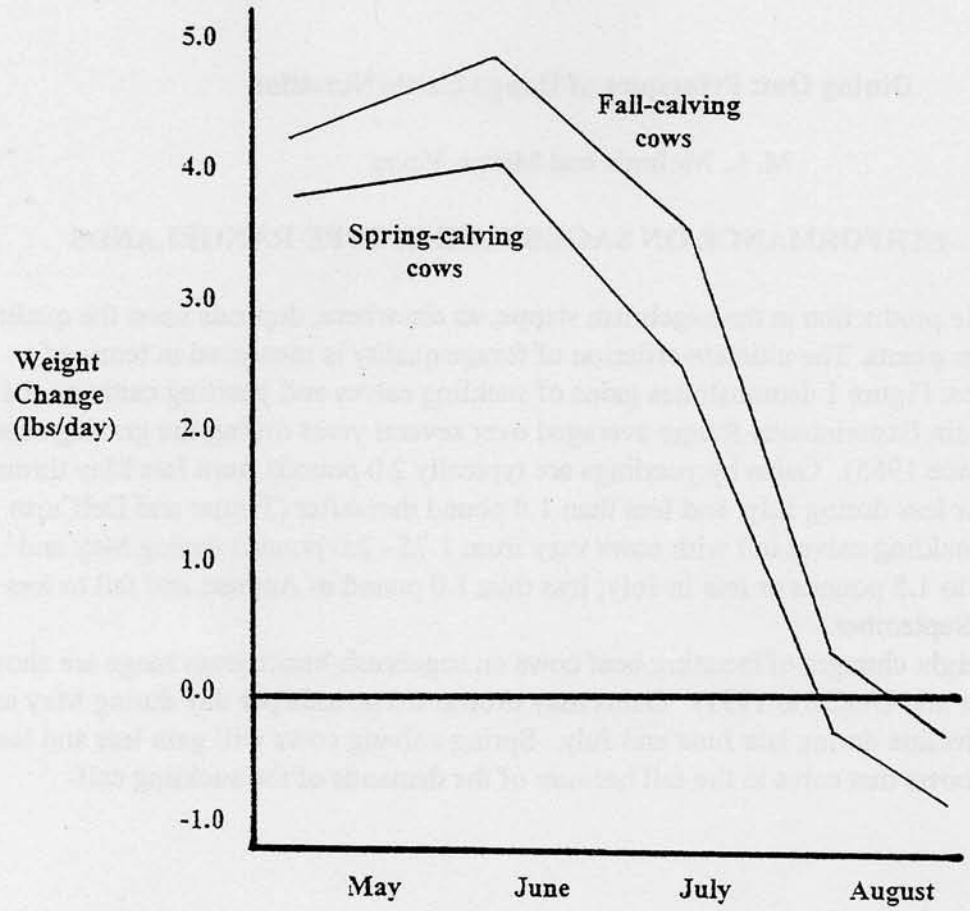

Figure 2. Weight change of lactating cows during the summer grazing season on sagebrush-steppe rangeland (after Turner and DelCurto 1991).

NUTRIENTS AVAILABLE FROM RANGE FORAGES

The gain data in Figures 1 and 2 simplify the response of animals to rangeland forage, but do reflect the dependence of animal performance on the quality of forages consumed. Most animal gains on sagebrush-steppe rangelands are made during late spring and early summer. Weight gains diminish rapidly as plants mature and forage quality fails to meet requirements for optimum growth sometime during mid-summer. The pattern of winter-spring precipitation and summer drought on sagebrush-steppe rangelands dictates a single growth cycle of forages. Thus, range forages typically provide optimum levels of nutrients and animal performance for only 2-3 month of the year.

There are many measures of forage quality including palatability, intake, digestibility, and levels of various nutrients. The principal nutrients of rangeland forages that limit animal performance are typically protein and energy. Mineral content of forages varies considerably with soil type and plant species, but phosphorous is often the most limiting. Deficiencies or toxicities of other minerals must be dealt with individually from one area to another. Vitamin A

deficiency is a problem only in animals fed dry weathered feeds for 6 months or more.

Protein and energy requirements of beef cattle may be expressed in different ways. Figures 3 and 4 show seasonal declines in digestible nitrogen ("protein") and digestible energy, respectively, typical of maturing perennial bunchgrasses on sagebrush-steppe rangelands. Range grasses may fail to meet protein requirements of lactating cows by the time of seed shatter. Of course, elevation influences the yearly growth cycle of plants so that those at higher elevation mature later in the grazing season. Annual variations in climate also influence plant maturation. Browse and forbs tend to have higher levels of protein compared to grasses, especially late in the growing season. On the other hand, grasses supply more energy than browse or forbs, even after seed-shatter. Still, range forage may not meet the requirements of lactating cows after mid-summer.

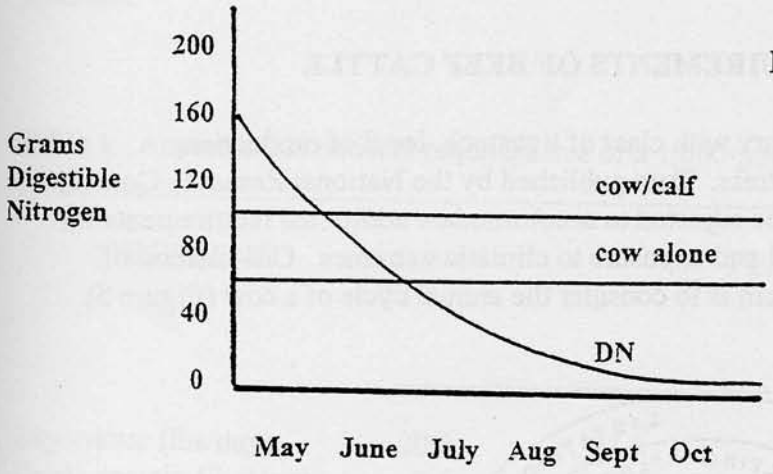

Figure 3. Digestible nitrogen (DN) typical of range forage compared to levels required by cows with calves and dry cows (after Bedell 1980).

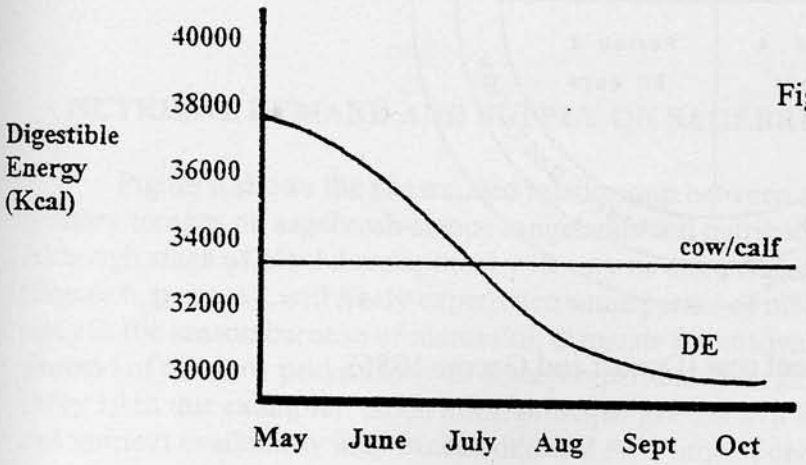

Figure 4. Digestible energy (DE) typical of range forage compared to levels required by cows with calves (after Bedell 1980).

Stage of plant maturity probably influences forage quality more than any other factor. Environmental parameters such as shading, soil type, and topography alter nutrient availability of plants by influencing phenology. Plants shaded by a shrub canopy may be slower to mature, contain higher levels of protein and minerals, and lower dry matter content than plants exposed to full sunlight. Range sites vary by topography, soils and climate. Plants on south-facing slopes are usually more advanced phenologically than plants on north-facing slopes. Leaf-stem ratios, protein, dry matter, mineral content and soluble carbohydrates are affected by the range site in which plants grow. Nutrient availability of forage on good versus poor condition rangeland depends on species composition. Forage species vary in their growth cycles with some plants maturing faster than others. Diverse plant communities that support green plants throughout the grazing season are better suited to meet nutritional needs of animals throughout the entire grazing period.

NUTRIENT REQUIREMENTS OF BEEF CATTLE

Nutrient requirements of cattle vary with class of livestock, level of production, physiological state, and environmental stress. Data published by the National Research Council (NRC) are accurate guidelines, and can be adjusted to accommodate additional requirements for range cattle to meet their needs for travel and exposure to climatic extremes. One method of planning a breeding herd nutrition program is to consider the annual cycle of a cow (Figure 5).

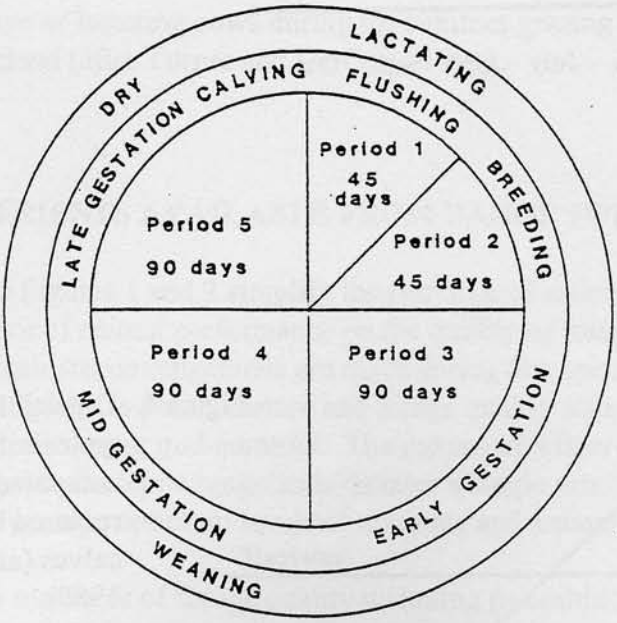

Figure 5. Annual cycle of a breeding beef cow (Dunbar and George 1986).

During period 1, cows have just calved and are lactating at their highest level. Additionally, they must begin recycling in preparation for breeding season. Nutrient requirements of a 1,000-pound breeding cow are shown in Table 1. Breeding occurs during Period 2. Cows are still lactating heavily and nutrient demands are high. During periods 1 and 2 cows require 112 percent more protein, 36 percent more energy, and 124 percent more calcium and phosphorous than during gestation (Dunbar and George 1986). These are the two most important periods during the nutritional calendar of a cow. Insufficient nutrition during periods 1 and 2 can lower milk production, calf growth, estrus, conception rates, and body condition. Period 3 is the season of early gestation. Cows are still lactating, but nutritional demands are diminishing. A cow's nutritional requirements during period 4 are the lowest in the cycle. During this period, a cow's principal function is maintenance of the developing fetus. Period 5 represents the last third of gestation. Nutrient demands of the cow are increasing because of the rapidly developing fetus. Additionally, the cow should be gaining weight in preparation for lactation.

Table 1. Approximate nutrient requirements of a 1,000-pound beef cow (NRC 1984).

NUTRIENT	PERIOD				
	1	2	3	4	5
Dry matter (lbs/day)	20.6	21.0	19.5	18.1	19.6
Crude protein (lbs/day)	2.5	2.6	2.0	1.3	1.6
ME (Mcal/day)	22.7	23.0	19.0	14.5	17.3
P (grams/day)	25.0	27.0	20.0	15.0	18.0
Vitamin A (1,000's IU)	37	38	36	25	31

NUTRIENT DEMAND AND SUPPLY ON SAGEBRUSH-STEPPE RANGELANDS

Figure 6 shows the generalized relationship between availability of nutrients from primary forages on sagebrush-steppe rangelands and nutrient demand by a breeding beef cow. Although stage of plant development will vary as discussed above, a cow that calves March 1 (Figure 6, point A), will likely experience some period of inadequate nutrition from range forage early in the season because of increasing demands for nutrients by the lactating cow. Nutrient demand of this cow peaks about 80 days postpartum when lactation reaches its maximum level (May 19 in this example). Soon after, principal grasses will likely peak in biomass and quality, and nutrient availability may exceed demand for a time. Forage quality declines rapidly after

seed shatter and plants enter senescence. There will typically be a second period of nutrient deficiency that will persist until weaning (Figure 6, point B), which normally occurs about 205 days postpartum (October 23 in this example).

The challenge faced by managers is to manipulate either the nutrient supply curve or the nutrient demand curve to reduce or eliminate periods of inadequate nutrition. Several management strategies are available including delaying calving, early weaning, supplemental feeding, and range seeding. Such management strategies are the topic of the paper by DelCurto and Vavra (this Special Report).

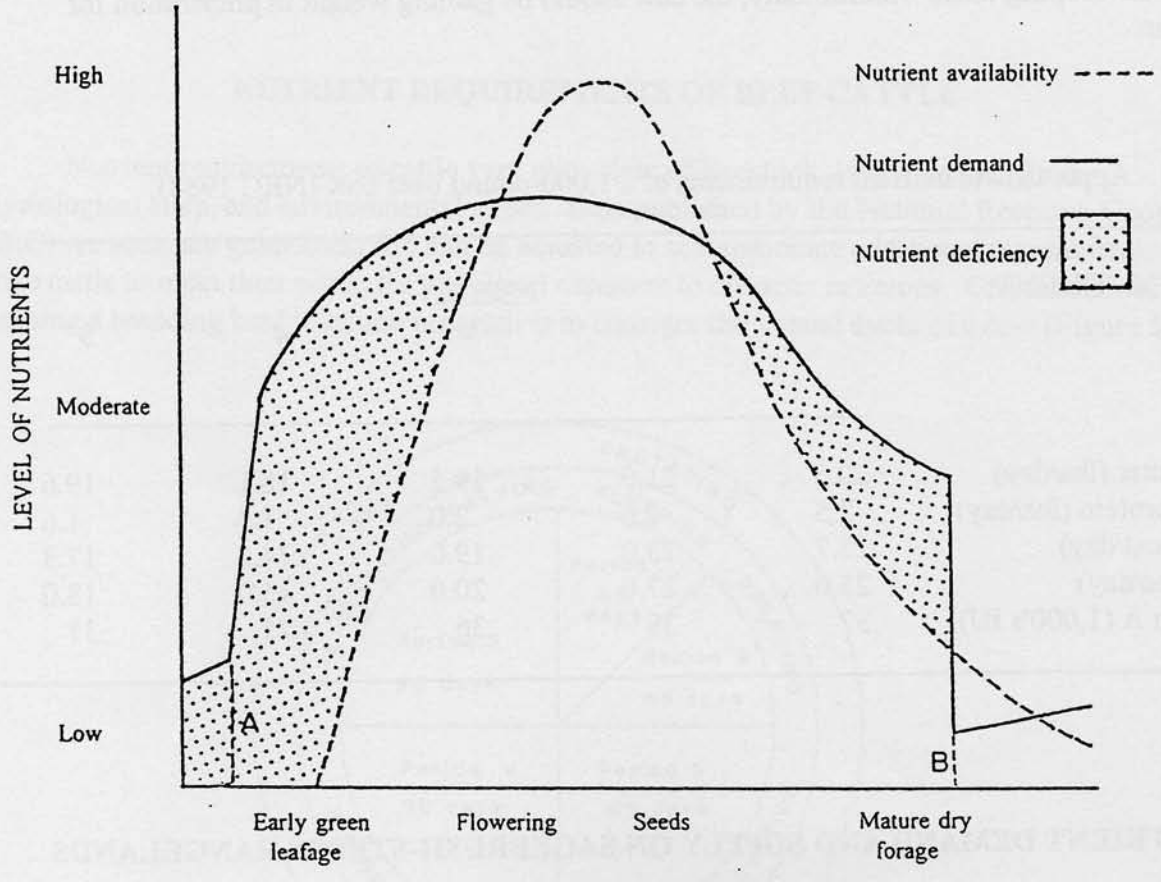

Figure 6. Generalized relationship between nutrients supplied by principal forages in the sagebrush-steppe and nutrients required by a breeding beef cow. Point A represents a hypothetical calving date of March 1, and point B represents a weaning date of October 23 (205 days postpartum).

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