Basic Nutrition of Bison

Saskatchewan
Agriculture

TABLE OF CONTENTS

LIST OF TABLES

FEED INTAKE, DIGESTIVE SYSTEM, AND SEASONAL PHYSIOLOGY

Introduction

Most of the information available on bison nutrition has been extrapolated from beef cattle requirements, bison forage selectivity, current knowledge of the bison digestive system and growth and seasonal adaptations. Specific energy, protein, mineral and vitamin requirements have yet to be fully developed. **When feeding bison, several concepts must be understood: a) bison are ruminants, and all diets must be forage based prior to considering the use of grain supplementation and b) weight loss will happen at certain times of the year and planning is required prior to such periods.** Finally, it is important to read through this entire document prior to making any decisions on a year round feeding program.

Dry Matter

Dry matter (DM) is the weight of the feed once all moisture is absent. For example, alfalfa hay containing 10% moisture (as fed basis) will have a dry matter value of 90%. This is calculated by subtracting the moisture level in the feed from 100 (e.g. 100 - 10 = 90). Therefore, a bale of alfalfa hay weighing 1,000 lb. at 10% moisture (90% DM) has a total of 900 lb. hay on a dry matter basis. The value of 900 lb. was achieved by multiplying 1,000 lb. x 90%. Conversely, 900 lb. of alfalfa hay dry matter would equal 1,000 lb. as fed basis (900 lb. ÷ 90% = 1,000 lb.). Conversions between as fed and dry matter are necessary, not only for estimating nutrient levels consumed but also for estimating actual as fed feed amounts required on a daily, monthly or yearly basis. Finally, all nutrient requirements for ruminants are expressed on a dry matter basis.

Dry Matter Intake

Dry matter is important for other reasons. Total dry matter intake for ruminants can be estimated as a percentage of body weight. For beef cattle, dry matter intake will vary when consuming forages ranging in quality (Table 1). As the forage fiber level increases, the digestibility of that feed decreases. This results in a reduced level of feed intake as the rumen requires a longer period of time to digest the fiber. Thus, the rumen stays full longer, reducing feed intake. While Table 1 refers to cattle and cannot be directly related to bison, it does show that predicted dry matter intake changes with changing forage quality.

Table 1. Dry matter intake of beef cows consuming high to low quality forages.

Feed	Dry Matter Digestibility (%)	Per cent ADF [z] (100 % DM)	Dry Matter Intake (% of body weight)
Excellent Quality Hay	65	29	3.0
Silage	60-65	36	2.5 - 3.0
Very Good Hay	60	36	2.5
Medium Quality Hay	55	39	2.0
Poor Hay, Barley Straw	45	49	1.5
Wheat Straw	35-50	54	1.0

[z] ADF = Acid Detergent Fiber

SOURCE: Saskatchewan Feed Testing Laboratory, 1990.

Factors Affecting Nutrient Requirements

Digestive System

Bison are grazing ruminants that have a four chambered stomach for feed digestion. The first two stomach chambers are the rumen and reticulum. A bison's rumen is very structured, ensuring that forage based feeds are retained for long periods of time. As a result, bison only feed four to nine times a day, consuming large quantities of forage per feeding. In comparison, deer consume smaller quantities of feed more frequently throughout the day. Bison also retain feed in their digestive system longer than cattle (Table 2).

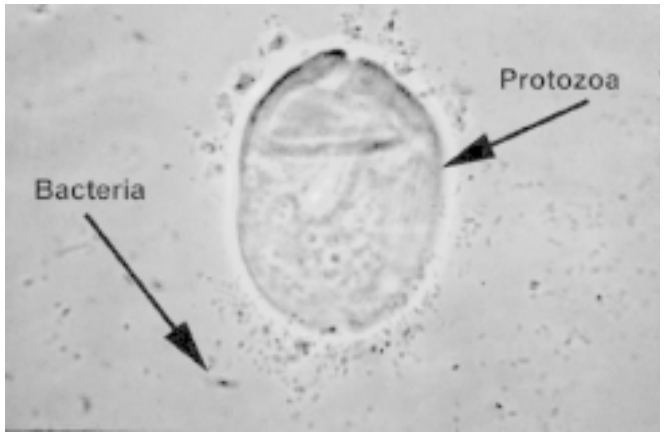
Longer feed retention means that bison have more time to digest the fiber in feeds such as sedges and grasses. However, when consuming alfalfa or alfalfa brome hay, there is virtually no difference in digestibility between bison and cattle because the fiber level in alfalfa based forages is typically lower than in grasses and sedges. Forages with lower fiber levels do not need to stay in the digestive tract as long to be fully digested as compared to forages with higher fiber levels.

The rumen and reticulum are populated with microorganisms such as bacteria and protozoa. These micro-

organisms utilize the fibers in forages and starches in grains to produce acetic, propionic and butyric acids. These acids are absorbed through the wall of the rumen into the blood stream to be converted into energy by the liver. Forages contain higher levels of fiber and lower levels of starch than grains and when utilized by the microorganisms, the amount of acid produced can easily be absorbed.

When suddenly introduced to high grain diets, the microorganisms produce higher levels of acid. Higher acids levels can potentially result in liver abscesses, rumen ulcers, acidosis (otherwise known as feedlot bloat), founder and even death.

The microorganisms also break down feed protein and nitrogen to create their own protein. This microbial protein, as well as minerals and vitamins, are passed down the digestive tract for absorption in the large and small intestines.



Picture of protozoa (large circle) surrounded by smaller bacteria in the rumen. Photo: Dr. G. Jones.

Table 2. Comparison of total tract retention time and dry matter digestibility of forages between bison and cattle.

	Bison	Cattle
Total Tract Retention Time (h)	78.8	68.7
Dry Matter Digestibility (%)		
Sedge hay	64	58
Grass hay	74	62
Alfalfa/brome hay	50	52

SOURCE: Schaefer, A. L., Young, B. A. and Chimwano, A. M. 1978

Growth and Seasonal Physiology of Bison

Growth and Development of Calves

When born, most calves have a mid-May birth weight of 40 to 75 lb. and can gain 1.2 to 2.0 pounds per day until weaning at 7 months of age (Figure 1). At weaning, an average weight of 400 pounds for heifer calves and 500 pounds for bull calves should be achievable under normal feeding and feed management conditions. From January to April, calf growth rate will vary depending on the feeding program. If fed a grain supplement with a grass or legume hay, it is possible for bison calves to gain approximately 0.75 to 1.5 pounds per day. Dry matter intake levels for calves will range from 2.0 to 2.4% of body weight from December to 18 months of age. Upon reaching 18 months of age, a lifetime cycle of reduced dry matter intake and weight loss in the winter followed by higher dry matter intake and weight gain in the spring/summer will occur.

Growth rate of calves depends on the feeding program.

Seasonal Weight Changes of the Mature Cow

Once bison reach 18 months of age, they begin a lifetime cycle of winter weight loss followed by spring/summer weight gain. Figure 2 shows a typical weight

cycle and estimated dry matter intake for bison cows throughout the course of a year. From December to April, it is not uncommon for mature bison to lose 10 to 15% of pre-winter body weight. For example, a 1,000 lb. cow in December will weigh 900 lb. in April, a loss of 10% of body weight. Dry matter intake at this time would be 1.4 to 1.8% of body weight. **If greater than 20% of pre-winter body weight is lost, there is an increased risk for abortions, stillborn calves, or if calves are born, smaller and weaker calves.**

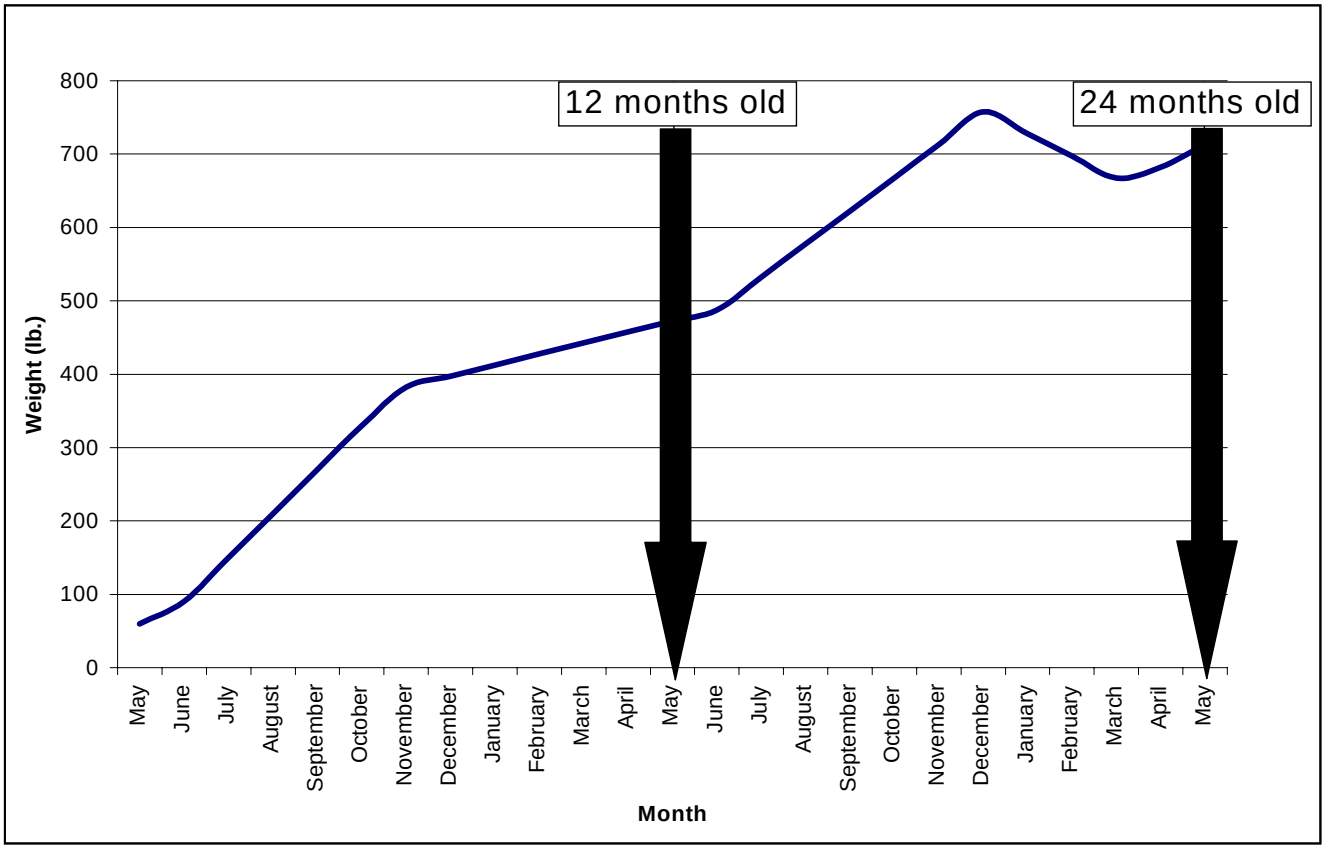


Figure 1. Weight curve for female bison from birth to 24 months of age.

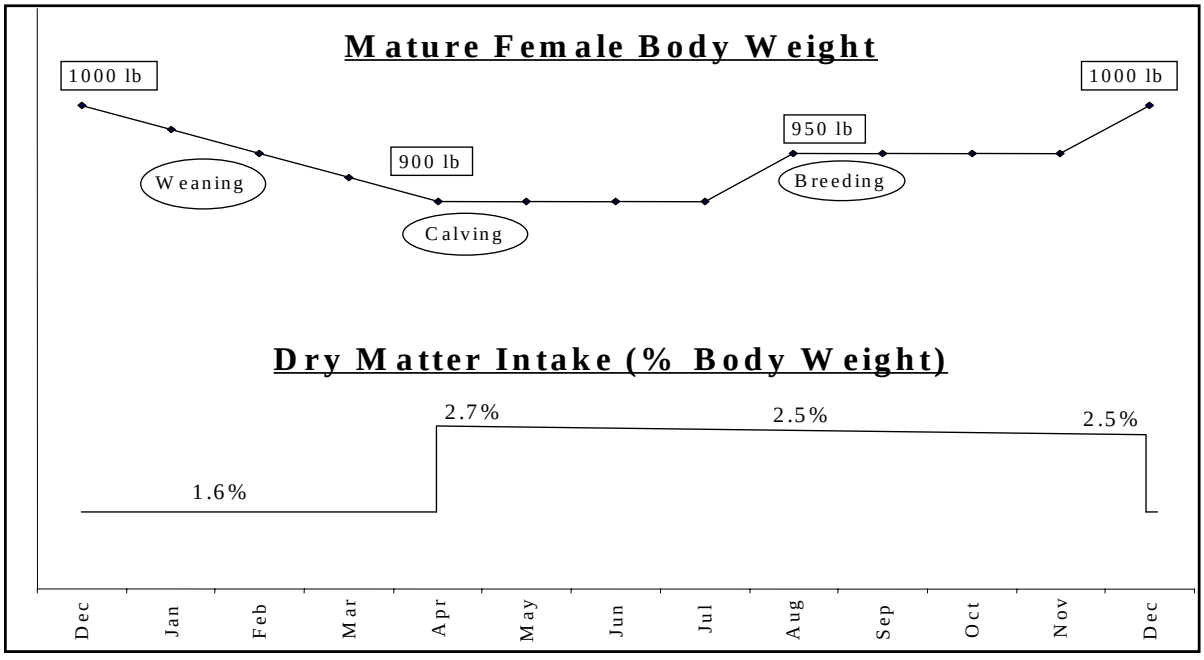


Figure 2. Seasonal weight changes of mature female bison.

In the last 2 to 6 weeks prior to the calf being born, the fetus is rapidly gaining weight. This increases the nutritional requirements of the cow. Dry matter intake will increase to 2.7 to 3.0% of body weight and will remain high to support the growth of the fetus. Once the calf is born in May or June, the weight of the cow will be reduced by another 100 lb. (calf weight, placenta and fluids). Dry matter intake will remain high to support lactation.

From May to August, lactation demands on the cow are slowly decreased. This is due to the calf becoming less dependant on the cow's milk and more dependant on pasture forages or creep feed. This reduced demand is timely as it allows the cow to partition more feed nutrients into her own body to gain weight. A steady rise in body weight and condition is necessary to enable the cow to begin its estrous cycle in August for breeding. Breeding in August ensures that calves are born at an optimal time in May.

Thin or poorly conditioned cows most likely will not conceive. In contrast to thin cows, cows that are too fat may not conceive either. This reflects the importance of winter weight loss followed by a rising plane of body weight and condition.

Once bred, the cow has from August to December to regain her original weight or heavier to allow for a safe level of winter weight loss. Thin or poorly conditioned cows entering the winter will still lose weight and be more expensive to feed.

This weight loss in the wintering period is a result of a reduced metabolic rate and cannot be changed, hence the importance placed on prior planning for autumn weight gain.

Seasonal Weight Changes of the Mature Bull

A bison male at 18 months of age will begin a lifetime cycle of winter weight loss followed by spring/summer weight gain. Mature bulls will also lose weight during the breeding season, followed by a final period in the fall to allow for weight gain. **It is important to plan a feeding program prior to these periods of weight loss.** Much like mature females, bison bulls can lose 10 to 15% of their pre-winter body weight from December to April due to a slower metabolism. During this winter period, dry matter intake will range from 1.4 to 1.8% of body weight. If grass hay diets are supplemented with grain, winter weight loss will be minimized, but compensatory gains in the spring and summer will not be as great. During the breeding season, bulls can potentially lose 10 to 15% of body weight again. Therefore, it may be necessary to provide extra energy through supplementation to prevent too much loss of body condition. Excessive loss of body weight during breeding makes it more difficult for the bulls to regain a proper weight status prior to the start of the wintering period. It is important to ensure the bulls are of adequate body condition prior to the winter and breeding seasons. Much like the cows, thin or poorly conditioned bulls entering the winter will still lose weight and be more expensive to feed.

Metabolic Winter Weight Loss

Changes in body weight and dry matter intake by bison 18 months of age and older is directly related to season, or more specifically, daylength. Daylength affects the pineal gland located near the base of the brain.

Body weight and feed intake varies according to the season.

This gland secretes a hormone (melatonin) which inhibits secretions of hormones such as growth hormone (IGF-1) and a metabolism controlling hormone (thyroxin). High levels of growth hormone and thryroxin are related to a faster metabolic rate, whereas low levels are related to a lower metabolic rate.

Bison metabolism in the winter is at a maintenance level due to higher concentrations of melatonin inhibiting the secretions of growth hormone and thyroxin. A

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