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FINISHING BISON BY OFFERING A CHOICE OF FEEDS AND ROOM TO ROAM

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ABSTRACT

This paper examines several methods of finishing bison. All studies were conducted on commercial bison operations. In the first study, one group of bison was fed a total mixed ration (TMR); the other group was offered a choice between poor quality grass hay and an energy pellet. In addition, bison fed the TMR were more closely confined than those offered choice. Bison fed choice had higher average daily gain (ADG), lower cost of gain and lower death loss than animals fed the TMR. The second study utilized low, medium, and high-input finishing systems. Bison in the low-put system had the lowest ADG and cost of gain compared to the other two systems. The third study examined bison finished: 1) in a traditional feedlot, 2) with a choice of feeds in loose confinement, and 3) on pasture that were supplemented with a choice of grains. The loose confinement group had the highest ADG than the other groups, but the supplemented pasture group was least costly to finish. The last study looked at a bison feeding operation changing from a TMR to a choice of feeds. Bison offered choice had higher ADG, suffered less illness, and timid animals finished as quickly as more aggressive animals. When finishing bison, offering them a choice of feeds, providing adequate space, and leaving young bison on pasture or rangeland as long as possible provided benefits for producers in terms of lower costs of gain, higher ADG, and reduced illness and death.

INTRODUCTION

Bison evolved eating a variety of feeds that varied in nutrients and toxins (Freeland and Janzen, 1974). In addition, their diet was often comprised of poor quality roughage (Bamfort, 1987). In contrast to these dietary habits, many feeding systems finish bison using a single total mixed ration (TMR), high in concentrates and low in roughage. TMRs are typically formulated for the "average" animal, but few animals are "average" (Provenza et al., 2003). Feeding a group of ruminants the same TMR doesn't consider that some animals have different nutritional needs or tolerances compared to the "average" individual (Provenza et al., 1996; Villalba and Provenza, 1996; Scott and Provenza, 1999). Thus, feeding a TMR likely has negative effects on productivity because most animals don't receive nutrients in the correct quantities and proportions to meet their individual nutritional needs.

Allowing bison to select their diet from a variety of feeds may be superior to feeding a TMR. Livestock offered a choice of feeds increased intake, improved feed efficiency and decreased costs compared to feeding a TMR (Gorgulu et al., 2003; Askar et al., 2006; Zobel et al., 2009). Cattle offered choice were 19% less expensive to feed than cattle fed a TMR (Atwood et al., 2001). Sheep offered a choice of feeds were 6% cheaper to feed than those fed a TMR (Rodriguez et al., 2007).

Few studies exist on offering bison a choice of feeds during finishing. Anderson and Miller (1999) found no differences in feed efficiency and gains between bison fed a TMR and those offered a choice of hay and concentrates. Anderson (2001) found that bison fed a choice of hay and grain had the highest ADG and one of the lowest costs of gain compared to bison fed a TMR.

More information on finishing bison is needed. Bison operations exist in all 50 states and every Canadian province. According to the 2007 Census of Agriculture 4,400 ranches raised 198,000 head of bison across the U.S.; the Canadian herd is estimated at 220,000 head. Also, demand for bison meat is increasing (National Bison Association, 2013). This paper overviews several feeding methods on commercial bison operations.

MATERIALS AND METHODS

Study 1. Contrasting Feedlots: The Flying D is a 113,500-acre ranch located in the western United States near Bozeman, Montana. The ranch runs approximately 1800 mother-cow bison. Bulls are weaned from the cowherd as calves, supplemented on mature winter pasture, summered on grass pasture then placed into commercial feedlots at 17 to 22 months of age. Heifers are sold or kept as breeding stock or grass-finished for meat. The ranch's primary objective is to provide grain-finished bulls (24 to 30 months old) for upscale retail red meat trade. The ultimate goal is to produce fresh bison meat for these high-end retail 365 days per year.

Flying D does not grain finish their animals on the ranch, instead they send their bulls to custom feeders prior to slaughter. In 2002, a comparison of production and cost of two different feedlots had ranch manager, Mark Kossler, rethinking their method for finishing bison.

Bison bulls were finished at two feedlots, one in Colorado (CO) and the other in North Dakota (ND). The CO feedlot was a state of the art facility with superior management. Bison were fed a high quality TMR that was 12% crude protein and net energy gain (NEg) varied from 0.49 to 0.56 Mcal/lb. The TMR contained haylage, corn silage, alfalfa hay, corn stalks, prairie hay, beet pulp, rolled corn, corn steep and minerals. As animals gained weight, the energy in the ration was increased and the protein declined slightly. At the feedlot, 220 bulls shared a pen and each animal was allotted 22.7 yd²/pen and 12 inches of bunk space. Pen conditions were generally good.

At the ND feedlot, bison were offered poor quality grass hay (9-12% crude protein) and an energy pellet (NEg 0.58 Mcal/lb) in separate feeders. In general, hay was purchased mostly on price with less emphasis on quality. Thus, the ration was erratic. Each pen contained 60 animals. Each animal was allotted 40 yd²/pen with 8 inches of self-feeder space per animal. Level of management was average to low. Pen conditions were poor; often with deep mud in spring and large mounds of ice and snow in the winter.

Study 2. Comparing Three Methods: After receiving the results from the feedlots in CO and ND, Kossler started looking for better methods to feed bison. He took 660 head of bison bull calves and randomly split them into three groups. Groups were managed with low, medium or high input from weaning at 6 months to finish at around two years of age and 1050 lbs. During the study, performance and costs were closely monitored.

Bison in the low-input group were not weaned. They were tagged and immediately released back into the cowherd. At 18 months of age, they were removed from the cowherd, put into loose confinement and offered a choice of whole corn, wheat-middlings, grass hay and alfalfa hay.

Animals in the medium-input group were weaned and put on winter pasture until spring. They then grazed irrigated pasture until 18 months of age, finally being put into loose confinement and offered a choice of whole corn, wheat-middlings, and forages. This group was also offered whole corn and wheat-middlings at all times while on pasture.

The high-input group were weaned then kept in confinement and offered a choice of whole corn, wheat-middlings and forages until finished and sent to slaughter.

Kossler used actual costs. Pasture and yardage were charged at fair market value. Feeds were weighed prior to feeding. Pasture costs for a 600 lb yearling were \$12 per month for dry pasture and \$15 per month for irrigated pasture.

Study 3. Traditional Feedlot vs. Choice and More Room: Finally, Kossler conducted a study to see if bison performed better when animals were given a choice of feeds and housed in areas larger than typical feedlot pens. He compared three feeding systems: 1) traditional feedlot (TF), 2) loose confinement (LC), and 3) supplemented pasture (SP). All calves were weaned prior to the beginning of the study. Bull calves averaged 415 lbs/hd and were split between the LC and SP treatments with 218 in each group. The ranch did not include TF in this study, but Flying D and other bison ranches have a long history of finishing bison in traditional feedlots. This study use data from other groups of bulls fed in TF.

The LC group was housed in a large pen and allowed 400 yd²/animal. LC animals were given a choice of whole corn, wheat-middlings, alfalfa hay and oat hay in self-feeders. Animals on SP grazed dry winter forage on 5,000-10,000 acre pastures and were offered whole corn and pelleted wheat-middlings in self-feeders. During the growing season from June through September, SP animals rotationally grazed irrigated pastures. They grazed 33 acres at a time (600 yd²/animal) for four to nine days using electric fence. Animals in the TF treatment were fed a typical commercial TMR and were given 25 yd²/hd.

Yardage was charged at \$0.35/hd/day. Dry pasture cost \$2/month for each hundred pounds of live weight. Irrigated pasture was \$11.14/hd/month for June and July and \$7.33/hd/month for August and September because bison ate more grain and less pasture during these months. Interest was charged at 9% on the average value of the bison inventory and half the feed costs, yardage, and health expenses. Death loss was figured at 3% for TF and 2% for LC and SP.

Study 4. Choice vs. TMR: Increased Gains and Healthier Bison: The Iron Mountain Bison Ranch, located near the Colorado-Wyoming border, finished their bison using a typical TMR. Each morning, feed was mixed and fed to bison, but bison gains were poor and they often suffered from acidosis and scours. Ranch manager, Kent Fullerton, was unhappy with the results and finally quit finishing bison.

Then while attending a workshop, Fullerton heard Utah State University's Dr. Fred Provenza described a study where cattle performance improved when offered a choice of feeds rather than a TMR (Atwood et al., 2001). After the talk, Fullerton decided to finish a small group of yearlings by offering a choice of feeds: whole corn, dry brewers grain and alfalfa hay. Alfalfa hay was offered in a self-feeder for large round bales. Corn and brewers grains were offered ad libitum in portable cattle feeders.

RESULTS AND DISCUSSION

Study 1. Contrasting Feedlots: In general, offering bison a choice of feed was less expensive than feeding a TMR. In Study 1, Kossler was certain the CO feedlot would produce the best results based on its appearance and diet fed. Surprisingly, Kossler was wrong. Bison fed in the ND feedlot had a lower cost of gain, death loss and a higher ADG than bison fed in the CO feedlot (Table 1).

Table 1. Bison productivity, cost of gain, and death rate at two feedlots with different feeding programs and management.

Feedlot Location	ADG(lb/day)	Feed Efficiency (lbs of feed/lb of gain)	Cost of Gain (\$/lb)	Death Rate (%)
Colorado	1.54 to 1.65	10-12	0.8-0.9	2.5-3.5
North Dakota	1.69 to 1.89	10-12	0.7-0.8	0.5-3.5

Kossler reasoned that the difference between the two feedlots was threefold. First at the feedlot in ND, bulls were allowed to select their own diet, whereas at the CO facility animals were fed a single TMR. Bison are generalist herbivores and didn't evolve eating only one food or high quality TMRs with low levels of fiber. Numerous studies have examined the benefits of offering a choice feeds to livestock. Cattle offered a choice between grain and silage, preferred grain (70%) over silage (30%), had better feed efficiencies, but similar ADG compared to cattle fed a mixed ration of 80% grain and 20% silage (Zobel et al., 2009).

Offering sheep choice in dry lot increased their ADG (Askar et al., 2006), improved feed efficiency (Askar et al., 2006; Dikmen et al., 2009; Rodriguez et al., 2007) and reduced illness (Rodriguez et al., 2007). Lambs offered a choice between feed ingredients of a TMR selected more energy and less protein as they aged compared to lambs fed a TMR (Sahin et al., 2003; Askar et al., 2006). Goats also had higher ADG and improved feed efficiency when offered choice of feeds rather than a TMR (Goetsch et al., 2003). In dairy goats, choice increased intake of dry matter, energy and protein, increased milk yield and decreased live weight loss compared to goats fed a TMR (Gorgulu et al., 2003). In addition, offering food choice reduces stress in livestock (Villalba et al., 2011a) and reduces rates of food intake as animals switch back and forth among feeds. This feeding pattern allows for a more uniform spread of food intake across time, which may reduce acidosis and enhance efficiency of nutrient use (Villalba et al., 2011b).

Secondly, the ND feedlot allotted more room for each animal than the CO feedlot. This likely reduced the number of conflicts between bulls. Bison bulls are not accustomed to be tightly confined. As they mature to breeding age, bison become increasingly aggressive toward each other.

Thirdly, the group size per pen was much smaller in ND than CO. Larger group size coupled with less space per animal increases potential for "pecking order" conflicts as well as increasing overall stress which can increase acidosis in ruminants and negatively impact productivity (Gonzalez et al., 2008; Petherick and Philips, 2009).

Lack of choice, crowding and larger group size all led to greater levels of stress which were reflected in increased death loss, lower productivity, overall decrease in animal well-being and increased costs. Despite the poor pen conditions, Kossler felt the ND facility was a much less stressful environment than the CO facility.

Study 2. Comparing Three Methods: In Study 2, all bison were offered a choice of feeds, but differences in the three systems had a significant impact on the cost of finishing them. Bison in the low input system gained slower, but at a much lower cost because they required less labor and supplemental feed (Table 2). Bison from the medium and high input systems gained more weight early in the study, but rate of gain declined in fall and winter, which is typical for bison (Anderson and Miller, 1997; Church et al., 1999). There was no benefit to keeping bison in confinement and feeding them grain and hay. Nor was there a benefit to weaning bison calves, in fact finishing costs were higher in calves that were weaned in the fall. According to Kossler, bison cows stop producing milk in winter whether or not they still have a calf at their side as their metabolism becomes catabolic.

Table 2. Performance cost of gain, and days in confinement of bison using three different feeding programs.

Treatment Group	ADG (lb/d)	Cost of Gain (\$/lb)	Days on Feed in Confinement (days)
Low-Input	1.1	0.65	177
Medium-Input	1.4	0.79	176
High-Input	1.6	0.88	411

Study 3. Traditional Feedlot vs. Choice and More Room: In Study 3, bison in the LC group gained faster than those in the TF group indicating that crowding was likely a factor in finishing bison. Feed costs were highest for TF followed by LC then SP. Animals on TF and SP took longer to finish which increased yardage costs, but SP was cheaper to feed because during most of the trial they grazed on pasture resulting in lower feed and labor costs. Cost savings were \$89/hd for LC and \$164/hd for SP compared to TF (Table 3).

Table 3. Average daily gain, days to finish and various costs of fattening bison in a traditional feedlot (TF), loose confinement (LC), or on supplemental pasture (SP).

Feeding Method	ADG (lb/hd/d)	Days to Finish (days)	Cost of Gain (\$/lb)	Feed Costs (\$/hd)	Yardage Cost (\$/hd)	Cost Savings (\$/hd)
Traditional Feedlot	1.50	404	0.95	412	163	0
Loose Confinement	1.61	375	0.90	389	132	89
Supplemental Pasture	1.50	408	0.69	258	162	164

The SP system was financially superior to LC and TF because it reduced costs for overhead and mechanically harvested forages. It is also likely that SP resulted in the least amount of stress compared to the other systems because bison were in a natural environment (pasture or rangeland) with appropriate feeds and no overcrowding. The SP system could be used when excess standing forage is available on a farm or ranch. In poor forage production years, calves could be fed using the LC system (with food choice) which is clearly superior to the traditional feedlot system.

Study 4. Choice vs. TMR: Increased Gains and Healthier Bison: Changing feeding methods at the Iron Mountain Bison Ranch improved gains and reduced illness according to Fullerton. The yearlings gained 2.3 lbs/day. According to ranch records, bison averaged 1.7 lbs/day when they were fed a TMR. Furthermore, the best gains Fullerton had ever hoped for was 2 lbs/day. After changing the feeding systems to offering choice, bison average 2 lbs/d and some groups gained as much as 2.4 lbs/day.

Offering animals choice reduced costs and solved many problems. Feed no longer had to be ground and mixed, bison were fed twice a week instead of daily, and bison quit sorting through their rations. Acidosis and scours were eliminated – which translated into lower veterinary costs – along with the strong ammonia odor commonly associated with feedlots. Lastly, timid animals finished as well as the more aggressive ones. The new feeding strategy represented a win-win situation for everyone.

IMPLICATIONS

A choice-feeding system may be a superior alternative to conventional feeding systems for bison. Implementing a choice systems may be justified given the benefits of improved profitability and animal welfare. For some producers, especially of bison, pasture-based, multiple choice feeding systems may lower costs, improve welfare, increase profits and offer greater flexibility in land management.

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