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THE OPTIMAL COW SIZE FOR INTERMOUNTAIN COW-CALF OPERATIONS

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Introduction

The cattle industry is very competitive which is forcing cow-calf producers to strive for efficiency. Research has shown that as a cow's mature weight increases, feed efficiency decreases, as well as reproductive efficiency and other production factors.

The debate of the optimum cow size is partially due to the fact that over the last 30 years, cattle have been selected for feedlot performance, weaning weight and yearling weight. This selection has increased the average cow size from 1000 lbs. to 1400 lbs. (Schmid 2013).

The purpose of this paper is to illustrate the difference economically of three different cow weights (1,000 lbs., 1,200 lbs. and 1,400 lbs.) on three different resource bases. The first resource base (resource base 1) is able to graze their cow herd year round with minimal supplementation. The second resource base (resource base 2) requires the operation to provide the cow herd with all nutritional requirements for 3 months of the year through the use of mechanically harvested forages. The third resource base (resource base 3) requires the cow herd to be provided with all nutritional requirements for 6 months of the year through the use of mechanically harvested forages. This paper is based on the findings of Russell (2014).

Production

The same production benchmarks were used for each cow weight on each resource base. However, Hersom (2009) pointed out that as mature weight increases the age at puberty increases. Similarly, as weight increases the percent of heifers cycling and conception rate decreases. Hersom also showed that as cow size increased, calving rate decreased. This difference in calving rate specifically led to a reduced ability to remain in the herd (cull rate). Large cows had a cull rate of 52% compared to a 19% cull rate for smaller cows in the first five years. He also showed weaning rates for first and second calves were greater for the smaller cow sizes compared to large cows where the large cows had overall weaning rates less than 50%.

Carrying Capacity

Hersom (2009) also discusses cow feed efficiency and shows that a cow herds feed requirements amount to 50% to 75% of the annual maintenance costs of the herd. He points out the importance of grazing as much as possible, and that stocking density

then becomes increasingly important as well. He shows the difference in nutrient requirements for a 1,000 lb. cow and a 1,200 lb. cow during early lactation (three months after calving), at weaning (seven months before calving), and late gestation (one month before calving). Hersom showed that no matter the stage of production the heavier cow always requires a larger quantity of dry matter as well as total digestible nutrients and crude protein.

Because of narrowing profit margins and increasing costs, cattle producers must evaluate their management practices. Riggs (2009) noted that maintenance requirements of the cow account for about 70% of the feed consumed, leaving the remaining 30% for production. This means the 70% of feed used for maintenance provides no economic returns.

Dhuyvetter (2009) showed the difference in the weaning weights as a percentage of a cow's body weight. A 1000 lb. cow will wean approx. 48.5% of her body weight, a 1200 lb. cow weans 45.8% of her body weight and a 1400 lb. cow will only wean 43.6% of her body weight. Dhuyvetter also illustrates the point; as body weight increases stocking rate decreases while calf weaning rate increases and the percentage of the cow's body weight weaned decreases.

The most accepted method of calculating carrying capacity is done by calculating an animal unit equivalent (AUE). The formula for determining an AUE is as follows:

$$Animal\ Unit\ Equivalent\ (AUE) = \frac{(Live\ animal\ weight)^{0.75}}{1000^{0.75}}$$

Using this formula the animal unit equivalents were found for each weight and class of animal during the grazing season. These values are found in Table 1.

Table 1. Animal Unit Equivalents

Cow Wt.	1,000 lb.	1,200 lb.	1,400 lb.
Cows	1	1.15	1.29
First-Calf Heifers	0.9	1.02	1.13
Replacement Heifers	0.79	0.89	0.99

Table 2 shows the difference in carrying capacity of an operation that is able to run 500, 1,200 lb. mother cows, 92 first-calf heifers and 100 replacement heifers. The same operation is able to run 74 more 1,000 lb. mother cows and 54 fewer 1,400 lb. mother cows on the same resource base.

Table 2. Carrying Capacity

Cow Wt.	1,000 lb.	1,200 lb.	1,400 lb.
Cows	574	500	446
First-Calf Heifers	106	92	82
Replacement Heifers	115	100	89

Expenses

The resources that are available to an operation will largely determine feed expenses. However mature cow weight also plays a role. Russell (2014) shows that supplement costs per head for hay and range cubes (protein) increase with body weight in all cases. When charged for federal and state grazing permits on a true Animal Unit Month (AUM) basis, the lighter cows have a lower feed cost and a higher total cost. However, as illustrated in Table 3, the higher total cost is due to the increased number of lighter cows a given resource base is able to sustain. Table 4 shows that

when an operation is charged for federal and state grazing permits on a per head basis, as is the normal practice, the heavier cows have the higher feed costs and total costs. These points drive us to examine revenues from nine different options.

Revenue

Since calf revenue generally represents 75% to 90% of operating revenue it is imperative to raise calves that maximize revenues while minimizing expenses (optimize net returns). It is also important to understand that lighter calves tend to sell for a higher price per pound than heavier calves, while heavier calves tend to bring greater revenue per head than the lighter calves. Furthermore, price per head for cull animals generally increases with body weight, however as carrying capacity goes up so does the number of cattle culled. At first glance one may think that selling the larger animal will generate the greatest net return, however, if we consider the difference in stocking rate on a fixed resource base this does not always hold true.

Table 3. Costs When Charged on a True AUM Basis

Cow Weight	1000 lb.	1200 lb.	1400 lb.
All Animals	795	692	617
Resource Base 1			
Fixed Cow Cost	$106,756	$93,023	$82,927
Feed Costs	$201,018	$202,640	$205,600
Total Costs	$307,774	$295,663	$288,527
Cost per Head	$387.14	$427.26	$467.63
Resource Base 2			
Fixed Cow Cost	$113,340	$98,760	$88,042
Feed Costs	$251,686	$253,585	$255,404
Total Costs	$365,026	$352,345	$343,445
Cost per Head	$459.15	$509.17	$556.64
Resource Base 3			
Fixed Cow Cost	$119,296	$103,950	$92,830
Feed Costs	$292,152	$293,711	$295,788
Total Costs	$411,448	$397,660	$388,618
Cost per Head	$517.54	$574.65	$629.85

Table 4. Costs When Charged on a per Head Basis

Cow Weight	1000 lb.	1200 lb.	1400 lb.
All Animals	692	692	692
Resource Base 1			
Fixed Cow Cost	$93,023	$93,023	$93,023
Feed Costs	$175,687	$191,772	$209,135
Total Costs	$268,710	$284,794	$302,158
Cost per Head	$388.31	$411.55	$436.64
Resource Base 2			
Fixed Cow Cost	$98,760	$98,760	$98,760
Feed Costs	$219,837	$246,484	$272,285
Total Costs	$318,597	$345,244	$371,045
Cost per Head	$460.40	$498.91	$536.19
Resource Base 3			
Fixed Cow Cost	$103,950	$103,950	$103,950
Feed Costs	$255,097	$289,300	$322,211
Total Costs	$359,047	$393,250	$426,161
Cost per Head	$518.85	$568.28	$615.84

Based on the stocking rate for a given resource base, the number of calves weaned at a 90% weaning rate is illustrated in Table 55. Table 55 also shows calf weight based on mature cow weight. The amount of revenue generated by an operation will also depend on retention of calves for growing and/or heifer development. However, the point is clear that a larger number of light weight calves will generate more revenue.

Net Returns

When grazing fees are charged on a true AUM basis Russell (2014) shows the lighter cattle generating the greatest net return for all resource bases even though resource base three had a negative return for all cow sizes (Table 6).

Grazing Costs on Public Lands

There is a difference in the net returns when the grazing fees are charged on a true AUM basis compared to charging on a per cow basis which is the current method used by the federal and state agencies. When the major constraint for an operation is the

amount of forage available on public lands, and grazing fees are charged on a per cow basis then carrying capacity does not change based on AUE or cow weight.

Table 7 shows the differences in net returns on a per cow basis when grazing fees are charged on a per head basis as is more typically the case.

Table 5. Calves Weaned and Weaning Weight.

Cow Weight	1,000 lb.	1,200 lb.	1,400 lb.
Steers			
Calf Weight	500	565	630
Weaned Calves	306	266	238
$/lb.	$1.45	$1.33	$1.28
Steer Revenue	$221,850	$199,886	$191,923
Heifers			
Calf Weight	470	535	590
Weaned Calves	306	266	238
$/lb.	$1.29	$1.23	$1.21
Heifer Revenue	$185,528	$175,041	$169,908
Steers and Heifers			
Total Calf Revenue	$407,378	$374,927	$361,831

Table 6. Net Returns per Cow When Charged on a True AUM Basis

Cow Wt. Cows Bred	1000 lb. 680	1200 lb. 592	1400 lb. 528
Resource Base 1			
Net Return Per Cow	$ 51.30	$ 39.28	$ 36.73
Resource Base 2			
Net Return Per Cow	$135.50	$135.03	$140.74
Resource Base 3			
Net Return Per Cow	($16.96)	($37.26)	($47.63)

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Table 7. Net Returns per Cow When Charged on a per Head Basis

Cow Wt. Cows Bred	1000 lb. 592	1200 lb. 592	1400 lb. 592
Resource Base 1			
Net Return Per Cow	$134.72	$153.39	$177.11
Resource Base 2			
Net Return Per Cow	$50.46	$51.28	$60.75
Resource Base 3			
Net Return Per Cow	($17.87)	($29.81)	($32.35)

When carrying capacity does not change with cow weight then there is not enough increase in net returns for the lighter cattle to offset the decrease in the costs of the heavier cattle. The carrying capacity of all three resource bases when state and federal grazing permits are charged on a per head basis is 500 head of cows and will require 92 first-calf heifers and 100 replacement heifers regardless of weight to maintain the herd. However, this policy in the long run, likely contributes to over grazing of range allotments which may then result in a forced reduction in the number of permitted cattle on an allotment.

Conclusion

This data strongly suggests that if producers are charged for grazing public lands on an AUE basis that a 1,000 lb. cow

would generate the greatest return on all three resource bases. However, in reality producers are charged on a per head basis for grazing their cattle on public lands. This current policy from the perspective of maximizing profit results in the 1,400 lb. cow being the best option for resource bases 1 and 2. This suggests that the current state and federal grazing rate policies do play a part in the cow size that is selected by producers on these two resource bases. However, on resource base 3, the 1,000 lb. cow loses the least amount of money. The results suggest the current grazing rate policies have little or no effect on cow size selected by producers on resource base 3.

In this and other research, it has been shown that body weight effects dry matter consumption and indicates that charging for grazing fees on a per head basis is not an accurate method of charging for the amount of forage removed. Not accounting for different forage intake from different sized cows could have a negative effect on range condition.

Each rancher should carefully evaluate their resources and select the cow size that will be best for their operation. This research has shown that Bigger is not always Better.

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