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OPTIMUM MANAGMEMENT FOR BACKGROUNDING SYSTEMS

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Diversity of Backgrounding Systems

I always tell students that I have the best job description in the world. I work in beef cattle production systems, which means I can conduct research on any topic that I want, as long as it is related to beef cattle, and I call it a system. Similarly, my mentor, Terry Klopfenstein, liked to say that every producer has a unique system, so our research programs will never be relevant to every producer. I preface my comments this way to acknowledge that it is impossible for me to describe optimum management for each backgrounding system. Each system is uniquely complex, and dynamic. Nevertheless, our goal is to provide information that is useful in decision making. This paper will attempt to present information on critical issues relevant to optimizing backgrounding systems.

Systems Analysis: Begin with the End in Mind

The overarching goal for most backgrounding systems is to utilize forage resources to add weight to growing calves. There are many macro-level benefits to our beef production system that result from backgrounding programs. For example, yearling cattle increase the amount of beef produced per cow exposed, a critical measure of efficiency in the system. Griffin et al. (2007) demonstrated that long-yearlings produce 50 pounds more carcass weight compared to calf-feds while consuming 77% as much feed during the finishing period. Additionally, backgrounded cattle are marketed at different times during the year, so our beef supply is extended.

For the individual producer, there are two critical pieces of information that need to be identified. First, what product is being marketed? System optimization (which is hopefully related to maximum profit) may differ for a cow/calf operator who is backgrounding through the winter months, a stocker cattle operator who is marketing to the feedlot, or an integrated operator who owns the calf from weaning until it is marketed to the packing plant. Our research program evaluates the system from weaning through the end of the feedlot phase and data tend to be interpreted for the producer who owns the cattle for that entire duration. However, we recognize that cattle may change ownership at various points in the system.

The second critical piece of information relates to the resources necessary to run the system. Since many backgrounding systems are based on a set forage resource, it is critical to first think about optimizing the use of the forage. Forages obviously vary greatly in both quality and price. When evaluating different forage options, it is beneficial to compare their cost per unit of energy. This can be accomplished by converting the price to $/lb on a dry-basis, and dividing by the TDN content (Table 1). While this process does not include the cost of processing and delivering harvested forage, it does illustrate that traditional grazed forages (summer range) has become expensive in Nebraska.

Table 1. Feed ingredient prices expressed as a function of their energy content.

Item	$/unit	$/ton (DM)	TDN, %	$/lb TDN
Sandhills range, stocker	$39.40/month[1]	$191.03[2]	63	0.1516
Grass hay	$70/ton	$77.78	55	0.0707
Grazed corn residue	$20/acre	$22.22[3]	55	0.0202
Baled corn residue	$60/ton	$66.67	43	0.0775
Corn silage	$31.98/ton[4]	$84.15	70	0.0601
Cracked corn	$2.83/bushel	$117.52	83	0.0708
Modified distillers grains	$52.25/ton	$104.50	108	0.0484

[1]Cornhusker Economics for North Region, published February, 2016.
[2]Assumes 550 lb steer consuming 2.5% of BW
[3]Assumes 225 bushel/acre corn harvest and 8 lb/bushel forage availability
[4]Assumes 225 bushel/acre corn harvest, $2.38/bushel corn price, and 38% DM silage harvest. Based on the economic analysis of Klopfenstein and Hilscher (2016).

Understanding the Nutritional Requirements of a Growing Calf

Beef cattle acquire amino acids for growth from dietary protein that escapes rumen degradation (rumen undegradable protein; RUP), and from microbial cells that are flushed from the rumen into the small intestine (bacterial crude protein; BCP). The amount of BCP that is produced is a function of dietary intake, and diet fermentability. Together, the RUP and BCP that are absorbed into the small intestine are known as metabolizable protein (MP). Young, growing calves have a high requirement for MP relative to their body weight because they are depositing muscle at a rapid rate. However, their dry matter intake is less compared to their older counterparts, and their diet may be less fermentable. As a result, BCP supplies a smaller proportion of their MP requirements compared to older cattle. From a practical standpoint, this means that growing calves benefit from RUP (or bypass protein) supplementation. Historically, RUP sources have been expensive or difficult to source. Distillers grains changed that. For example, we have established a response curve to distillers grains supplementation for growing calves grazing corn residue (Figure 1). At times when distillers grains prices are high, it is logical to substitute distillers grains with alternative supplemental feeds. Tibbitts et al. (2016) addressed this question by feeding corn, corn and urea, distillers grains, and Soypass (nonenzymatically browned soybean meal) to determine the need for supplemental RUP. All supplements provided equal energy so that the gain response was due to protein. Neither the corn, nor the corn and urea provided similar gains to the distillers grains or the Soypass (Table 2). Hilscher et al. (2016) added increasing amounts of Empyreal (high protein corn gluten meal) and Soypass to determine the optimum amount of supplemental RUP in silage-based diets. They observed a linear increase in ADG, and a linear improvement in feed converstion with increasing amounts of RUP (Table 3). While all diets need to be appropriately formulated for all nutrients, for many backgrounding situations, the largest return to supplement will be by providing RUP.

Figure 1. Effect of distillers grains supplementation on ADG of steer calves grazing corn residue. Adapted from Welchons and MacDonald, 2017

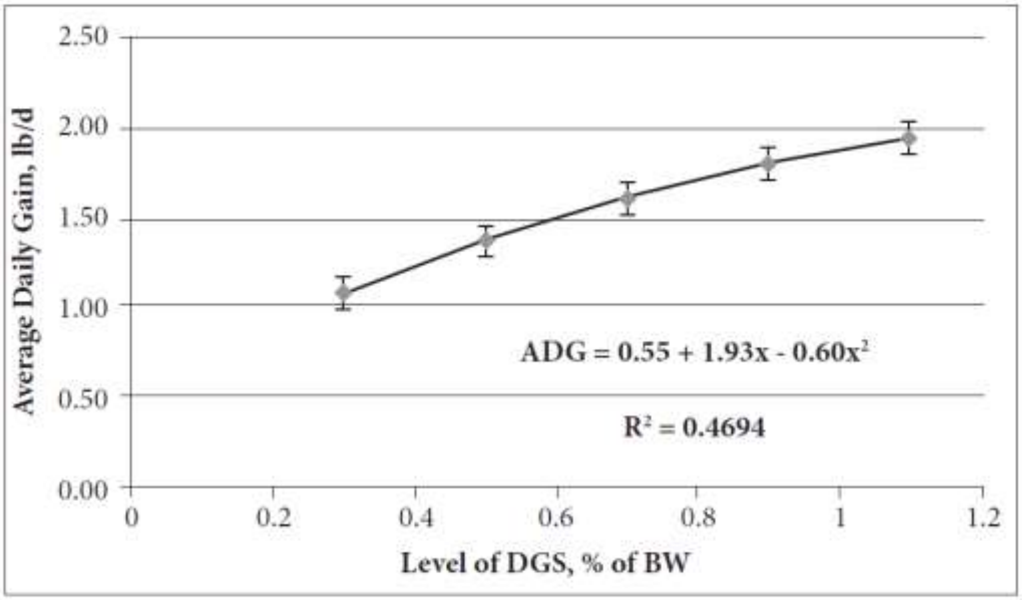

Table 2. Comparison of ADG response to protein and energy supplements for calves grazing irrigated corn residue[1]

	No Suppl.[2]	Corn[3]	Corn/ Urea[4]	DDGS[5]	Soypass[6]	SEM	*P*-value
Initial BW	516	516	516	516	516	3.5	0.1
Ending BW	504[a]	539[b]	559[c]	629[d]	640[e]	4.9	< 0.01
ADG	- 0.18[a]	0.31[b]	0.53[c]	1.32[d]	1.48[e]	0.06	< 0.01
Suppl. DMI, lb/d[7]	-	3.75	3.23	3.0	3.5	-	-
TDN, %	-	83	78	104	90	-	-
TDN intake lb/d	-	3.11	2.52	3.12	3.15	-	-
DIP balance, g/d	-144	-253	7	-161	-1	-	-
MP balance[8]	-19	126	93	144	258	-	-

[a-e] Means within a row with differing superscripts are different.
[1]Adapted from Tibbitts et al., 2016.
[2]Calves did not receive suppl. throughout feeding period.
[3]Suppl. contained 3.75 lbs. DM, whole corn.
[4]Suppl. contained 4 lbs. DM, 89% whole corn, 6% molasses, 5% urea.
[5]Suppl. contained 3 lbs. DM, dried distillers grains + solubles.
[6]Suppl. contained 3.5 lbs. DM, 60% soy-pass + 40% soybean meal.
[7]Suppl. was formulated to provide 3.12 lbs. TDN intake, which is the TDN amount supplied by 3.0 lb. dried distillers grains + solubles. This formulation requires differing DM amounts.
[8]Metabolizable protein balance to achieve the observed ADG for each treatment.

Table 3. Effects of increasing RUP in silage based growing diets on steer performance

	Treatments[1]					*P - value*	
Item	0%	2.5%	5.0%	7.5%	10%	Lin.	Quad.
Initial BW, lb	595	597	597	596	600	0.98	0.60
Ending BW, lb	791	824	855	842	868	< 0.01	0.88
ADG, lb	2.51	2.91	3.31	3.15	3.43	< 0.01	0.82
Feed:Gain	6.74	6.26	5.71	5.52	5.35	< 0.01	0.57

[1]Adapted from Hilscher et al. (2016). All cattle were fed 88% corn silage with a combination of RDP and RUP supplements to achieve either 0, 2.5, 5.0, 7.5, or 10% supplemental RUP (% of diet DM). The RUP source was a blend of Soypass + Empyreal in the final diet.

Supplementation: Added Cost or Profit Center?

Supplementation strategies that are put into place to increase production rather than correct a deficiency must return a profit. Therefore, backgrounding programs which employ protein and energy supplementation must understand compensatory gain. In short, the principles of compensatory gain suggest that cattle which exhibit lower ADG during a backgrounding phase will make it up during the subsequent growing or finishing phase. From a practical standpoint, it likely means that there must be more weight to sell in order to pay for the cost (purchase, delivery, labor) of providing the supplement. In the future, it may not be as simple as predicting compensatory gain. For example, Rolfe et al. (2012) supplemented yearling steers grazing Sandhills native range 0.6% BW modified distillers grains. Daily gain during the grazing season increased by nearly 50% (1.36 vs 2.03 lb/d for unsupplemented and supplemented steers, respectively), but the unsupplemented steers tended to compensate during the finishing phase (3.99 vs. 3.83 for unsupplemented and supplemented heifers, respectively; $P = 0.07$) such that there was no difference in the weight of carcasses sold. While additional weight did not pay for the cost of supplement, supplemented steers were still more profitable. Additionally, they estimated that each pound of distillers grains replaced 0.65 pounds of forage. If the price of grazed forage continues to increase in relation to the cost of distillers grains, it may be profitable to use supplement to increase stocking rates in addition to increasing ADG.

While there is not strong evidence for supplementation on summer grass, unless stocking rates are increased, there is strong evidence that supplementation during the winter period is beneficial. Gillespie-Lewis et al. (2016) evaluated both winter and summer supplementation strategies while spayed heifers (475 lbs) grazed corn reside through the winter, and then grazed Sandhills range through the summer. Heifers received either 2 or 5 pounds of distillers grains (DM-basis) while grazing corn residue, and then received either no supplement, or distillers grains supplemented at 0.6% BW while grazing range. Both winter and summer supplementation resulted in compensation in the subsequent growing phase. However, the magnitude of compensation was different. During the summer, heifers which had received 2 pounds of distillers grains compensated by 37% compared to heifers receiving 5 pounds of distillers grains. In the finishing phase, heifers receiving no supplement compensated 85% compared to heifers receiving distillers grains at 0.6% BW. As a result, winter supplementation increased hot carcass weight whereas summer supplementation did not. In an economic evaluation of the system, winter supplementation increase profitability (Table 4) whereas summer supplementation tended to reduce profitability.

Table 4. Effect of winter dried distillers grains (DDG) supplementation on system ADG and profitability[1]

Item	2 lb DDG	5 lb DDG
Winter ADG, lb	0.55	1.41
Summer ADG, lb	1.39	1.06
Feedlot ADG, lb	3.96	4.16
Final BW, lb	1,231	1,313
System Profit, $/hd	-9.64	46.26

[1]Adapted from Gillespie et al., 2014.

ADG: More is Better, or All Things in Moderation?

A logical question concerning winter supplementation is: how much gain should be targeted? Bondurant et al. (2016) supplemented 3, 5, or 7 pounds of distillers grains (DM-basis) to spayed heifers grazing corn residue. Gains increased from approximately 1.5 pounds/day to 2.0 pounds per day with increasing supplementation. In the first year of the two-year project (2012), subsequent ADG during the grazing period was quite low (0.5 to 0.8 pounds/day). While there was compensation, treatments did not maintain their weight difference at the end of the grazing period. Perhaps this illustrates the even the best-laid plans can go wrong at times. However, in the second year of summer grazing (2013), treatments responded as expected with compensation with increasing winter supplementation. In the second year, there was a linear increase in hot carcass weight with increasing amounts of supplementation, supporting the concept of increased supplementation during the winter period. Gillespie-Lewis (2015) conducted a sensitivity analysis where corn price and distillers grains price (as a % of corn price) was altered using an analysis of 6 combined experiments. Feeding distillers grains at a level that targeted 1.4 lb of ADG improved profitability, regardless of the price of corn ($3, $5, or $7/bushel), or the relationship of the price of distillers grains and corn (distillers grains priced at 80%, 95%, or 110% the price of corn). Within the data we have available, it appears that targeting 1.5 to 2.0 pounds of day during the winter period maximizes profitability of the system (weaning through finish) in most economic scenarios.

Conclusions

While each backgrounding system is unique, there appears to be tremendous opportunity to target up to 2 lb of ADG from weaning until spring grazing when the calf is approximately one year of age. Utilizing forage resources and supplements that are inexpensive per unit of TDN, such as grazed corn residue, makes this system even more advantageous. Supplementation of bypass protein is especially important in growing calves, which is why distillers grains have worked so well in backgrounding situations. Summer supplementation prior to entering the feedlot appears to be less beneficial unless stocking rate is increased to take advantage of forage replacement effects of supplementation.

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