Extension
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Options for feeding the beef cow herd when hay supplies are short

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Following are management options that a spring calving cow herd may consider to get through the winter feeding season when hay is in short supply. The examples given use general assumptions because options and costs vary from farm to farm and over time. Feed quality can vary significantly, and it is necessary to test feeds to make sure a balanced ration is being fed to minimize short and long-term health and production risks.

Reducing Feeding and Storage Shrink

Two of the easiest practices to help stretch feed supplies are to use storage and feeding methods that minimize the storage and feeding loss of hay and other feedstuffs. Observations from traveling around the countryside indicated there are many farm operations that could reduce hay waste by improved storage and feeding management. Research conducted by several universities has demonstrated that storing hay in a manner that does not allow water to wick up from the bottom or soak in from the top can greatly reduce hay loss from rotting. Table 1 is a summary of several hay storage method research trials. The longer the hay is stored in less-than-ideal conditions, the greater the amount of loss. In addition, higher quality hay will spoil faster than poor quality hay. Loss for different storage methods will vary due to length of storage time, weather conditions (temperature and rainfall), and hay quality. In addition to dry matter loss from poor storage, weathering reduces forage quality, decreases palatability and intake and increases feeding loss due to animal refusal. An example is where the cattle eat the middle of the bale and leave the rest.

Table 1. Summary of storage loss for hay by storage method

Type of Storage	Range of Dry Matter Loss	Average
On bare ground, uncovered	5 to 61%	27%
On gravel or pallets, no cover	3 to 46%	22%
On gravel or pallets, covered	2 to 17%	8%

On ground, tarped	5 to 30%	13%
On ground, wrapped	4 to 23%	13%
On ground, under roof	2 to 10%	6%
Inside a building	2 to 12%	5%

Adapted from Ruff and Hartschuh

Different designs of hay feeders vary in the amount of hay wasted. A Michigan State University research trial compared hay waste from different designs of hay feeders. The results are shown in Table 2. Additional information on minimizing hay storage and feeding loss can be found in the Minimizing Losses in Hay Storage and Feeding publication.

Table 2. Hay feeding loss by feeder type

Type of Feeder	**Percent Loss**
Ring Without panel	20%
Cradle Feeder	15%
Feeder Wagon	11.5%
Ring with Panel	6%
Cone Feeder with Panel	3%

Buskirk et.al.

Limit Feeding Considerations

Physical fill (gut fill) is one controlling factor of intake for ruminants. A cow fed “free choice” will typically consume hay until she meets this physical fill limit, “feeling full”. A beef cow will typically eat 2.0 to 2.5% of her body weight of forage dry matter daily. Forages, due to their slower fermentation and digestion rates, make cows feel full longer than more rapidly fermenting feedstuffs, such as corn or fibrous co-products. Limit feeding means that the cow is fed more nutrient dense feedstuffs and less bulk feed than would meet this physical fill limit. Thus, limit feeding reduces the “full feeling” a cow naturally tries to attain. When the cow feels hungry, she will search for something to eat. This will lead to more aggressive behavior, rapid consumption of feed when it is offered, and increased competition the next time access to feed is provided. Cows in search of something to fill their rumens are also more likely to challenge fences and gates as well as strip bark from trees.

Limit feeding is a strategy that aims to meet the nutritional needs of the cow with one or more feeds that are more nutrient dense and less bulky than average grass hay. These higher quality, more nutrient dense, and higher digestible feeds will be consumed if offered free-choice until the rumen is physically full. If she were to be fed as much as she could eat of these nutrient dense feeds, she would gain body condition, that is become fatter. Therefore, the amount of these feeds fed to the cow needs to be limited.

When limit feeding, at least 32 to 40 inches of bunk space per head is needed so all animals have access to feed at the same time. All cows must be able to consume their daily allocation of feed and not be chased away by boss cows. If bunk space is not adequate, the smaller and/or more timid cows will not get enough to eat.

A good management practice to follow, even in times of ample forage, would be to put the first-calf heifers and thin cows in a separate group. Grouping allows the younger females and thin cows adequate access to feed since they require a higher plane of nutrition as they are still growing or regaining body condition. If limit feeding needs to be done prior to the usual time of weaning calves, early weaning calves will be a better option than limit feeding the cows with calves by their side. If limit feeding nursing cows, providing a creep area for the calves to eat without competition from the cows will reduce injury risk to the calves and ensure they get adequate feed. Feeding management practices and feed bunks should account for these behavioral changes.

Substituting Corns Stalks or Conservation Reserve Program (CRP) Hay for Traditional Hay

Grazing “corn stalks”/residue after grain harvest is a common practice for feeding dry, mid-gestational beef cows after weaning calves on many farms. Cows selectively graze corn residue eating the leaves and husks along with the occasional dropped ear and spilled grain. Supplemental energy and protein may be needed if trying to add body condition to cows while grazing corn residues. Liquid protein supplements or free-choice tubs may fit in this situation to supply additional protein. Using a drift fence is one way to optimize consumption of the more digestible plant portions since access to corn stalks is limited. A drift fence, or in today’s grazing terminology strip-grazing, is a method for limiting field access by cows to that strip of field which is defined by electrified fencing. As cows selectively graze the husks and leaves, the fence is set back into the field to open up a fresh strip of corn stalks to graze. Do not force cattle to eat the cobs and stalks because this will result in them losing body condition. Additional information on grazing corn residue can be found in this University of Nebraska publication: Grazing Crop Residues with Beef Cattle.

Harvesting or purchasing corn residues or CRP type hay bales is another option to get a roughage source for feeding the cows when hay is in short supply. If harvesting corn

residues intentionally to use as feed rather than bedding, harvest should be done as soon after grain harvest as possible. Caution should be taken regarding risk from potential molds and mycotoxins. As described above, plenty of bunk space will be needed when feeding the energy and protein supplements so all cows can get access to those feeds. When feeding baled corn residues, considerable waste can occur as cattle will not readily consume the lower stalk portions. Ideally, harvested corn residues should be coarsely ground to improve intake.

In a recent trial at UW-Madison by Karls et al. (2022), confined growing beef steers (880 lb) were fed a diet consisting of chopped corn stover (20%, DM basis) along with corn silage (52%), DDG (25%), and 3% (mineral and vitamin) supplement. The corn stover fractions that were present in the stover bales (85% DM) are shown in Table 3.

Table 3. Composition of corn stover bales (n=14) and intake of corn stover fractions by growing steers fed in fenceline bunks.

	Total	Cob	Stalk	Leaf & Husk	Fine particles (<8 mm)
	(DM basis)				
Composition of bale, %	100	16	24	44	15
Intake/offered, %	55	40	58	56	65
Fraction intake, lb/steer/d	2.62	0.31	0.66	1.19	0.46
Fraction intake, %	100	12	26	45	17

The leaf and husk fraction was the greatest proportion in the bales at 44% while the cob and stalk fractions comprised 40% of the bale DM. Although this diet was presented as a total mixed ration, particle size varied enough that the steers could choose which feeds and stover fractions they wished to eat. They consumed only 55% of the stover offered to them, mostly in the leaf and husk fraction (1.19 lb/steer daily) and the cob fraction was least preferred. The cob fraction was 16% of the bale DM offered, but only 12% of the stover consumed. Yet while this indication of preference was evident, a more overarching summary is that these confined steers consumed stover fractions in proportions that were similar to those offered. This is in contrast to results reported for cattle grazing corn stover. Recent beef cow grazing research found the amount of cob and stem in corn fields were similar before and after cattle grazing, but leaf and husk were significantly reduced (Stalker et al., 2015). Cows and calves grazing corn residue avoid consumption of corn cobs and prefer to consume leaf and husk fractions. It seems that chopping and feeding corn stalks diminishes the avoidance of stalks.

Testing these feed sources is critical to determine energy and/or protein supplementation needed to meet changing cow needs, but collection of a representative sample of corn stover is challenging. For this reason, the nutritional composition of the

corn stover fed by Karls et al. (2022) is shown in Table 4. It is important to note that this stover did not receive rain before baling. Rain or snow melt would leach non-fiber carbohydrate from the stover.

Table 4. Nutritional composition of baled corn stover.

	Cob	Stalk	Leaf & Husk	Fine Particles (<8 mm)	Stover Consumed
	(DM basis)				
CP, %	1.8	3.8	3.6	5.6	3.8
Available CP, %	1.2	3.0	3.0	4.5	3.0
aNDF, %	87.8	79.4	79.9	75.5	80.0
ADF, %	47.9	54.6	49.5	48.2	50.4
Lignin, %	4.5	5.8	6.0	7.2	6.0
Starch, %	0.6	0.8	1.1	1.3	1.0
Non-fiber carbohydrate, %	10.1	12.0	11.3	11.5	11.4

The nutritional composition of the consumed corn stover was calculated by multiplying fractional intake of each residue component by its respective nutrient, and then summing these values. Corn stover has high fiber, low protein, and low starch contents. Based on the performance of the growing steers, Karls et al. (2022) estimated the net energy for maintenance and gain values respectively to be 0.44 and 0.20 Mcal/lb DM of corn residue.

Grinding and using a TMR mixer can help ensure that cows get a more consistent and adequate ration when using these feeds and the roughage component could be fed at an amount to allow the cows to “feel full.” However, blending concentrate feeds with corn residue can result in some of the concentrates appearing in the refused residue. Karls et al. (2022) estimated that DDG and corn accounted for 1.9% and 8.5% of refused residue DM.

To take this a step further, Table 5 uses Iowa State BRANDS ration software and “book values” for husk and leaf versus entire corn plant stover to estimate the voluntary intake and weight gain or loss by a 1400 lb beef cow with a body condition score of 5.5 during November weather conditions. Using just the husk and leaf portion mimics the selectivity of cows grazing corn residues while the chopped stover simulates baling stover and feeding in a dry lot.

Table 5. Estimated voluntary intake and performance of a 1400 pound body condition score 5.5 beef cow grazzing corn leaf and husk or fed chopped corn stover on dry lot during average November weather.

	Voluntary consumption	Weight Gain or Loss
	lb DM/day	lb/day
Leaf and husk[1]	26.7	0.3
Chopped stover[2]	23.0	-2.4

[1]Leaf and husk example includes a 10% increase in maintenance needs to reflect additional walking while grazing.

[2]Stover is defined as: the stalk, leaves, husks and tassels left in the field after harvesting the grain with a combine. Chopped would be tub grinding or processing in some manner to size it so animals would be less able to sort.

When feeding lower quality forages, use of an ionophore can help improve feed efficiency. Ionophores should be mixed with the grain supplement to reduce the risk of sorting and overconsumption. Since feeding grain mixes to cows grazing corn stalks is challenging, use of self-fed liquid protein supplements is a viable option.

Limit Feeding Corn Silage

Limit-feeding corn silage can also be an option for overwintering the beef herd. Corn silage provides about 40 to 50% grain and 50 to 60% roughage on a dry matter basis. Feeding 18.5 pounds of corn silage dry matter basis or approximately 45-50 pounds as-is will provide approximately 8.5 pounds of grain and 10 pounds of roughage on a dry matter basis. This amount of silage will provide a 1400-pound dry beef cow's energy needs in the 2nd trimester of gestation when environmental stress is not a factor. Because corn silage is higher in energy than typical beef quality hay, the cow's energy needs will be met with less total dry matter.

Cows should be limit-fed corn silage initially to allow them to acclimate to the taste of fermented feeds if they have never had silage to avoid digestive upsets. Feeding 15-20 pounds as-is for 4-5 days will allow the rumen microbes to acclimate to the starch intake and reduce the risk of foundering from ruminal acidosis. Cows can then be increased by about 5 pounds every 3-4 days until the target silage level is reached. When feeding corn silage, rumen degradable protein supplementation will be needed for optimal feed efficiency. Often 2-3 pounds of corn gluten feed, 2 pounds of dried distillers grains or a pound of soybean is sufficient to ensure adequate protein intake. If feeding corn silage from drought-stressed corn, more silage may be needed per cow due to lower energy from a lower grain content. Additionally, nitrate levels may be of concern if the drought conditions have been severe, though completely fermented silage will have low risk.

Corn silage can be an economical alternative for beef cows this winter. For example, if a 1400-pound cow is fed corn silage valued at $45 per ton as-fed, it costs $1.01 a day to feed the cow corn silage plus 2 pounds of dried distillers grains at $325/ton adds

$0.33 for a total daily cost of $1.34. If we compare that with $160 per ton of hay it would cost $3.28 a day to feed the cow hay, assuming a 1400-pound cow will eat 32 pounds of hay. When using good feeding and storage management there is little loss or waste when limit-feeding corn silage. However, not everyone may have access to corn silage or the facilities to effectively use it.

Substituting Grain for Some of the Hay

Another option to look at is substituting some of a cow's hay in the ration with corn grain and/or coproduct feeds. Corn grain and grain processing coproducts are more energy dense than hay, so it is possible to substitute a lower quantity of those products for some of the hay to meet cow needs. A general rule of thumb often heard is 1 pound of corn could replace 2 pounds of hay from a TDN standpoint. This may not be the precise substitution ratio needed to meet cow nutritional needs, but it can be used as a starting point. Hay quality, the cow's nutritional needs, amount of hay desired to be substituted, and available feeds will influence the actual amount of grain and protein supplement needed to replace the energy and protein provided by the hay. Similar to feeding corn silage, it will be necessary to slowly transition the cows from all forage to the forage and grain ration to minimize risk of acidosis and foundering.

Following are example scenarios for substituting corn for hay:

Stretching the hay supply with some corn grain

Under conditions where the hay supply is limited and the goal is to stretch the available forage supply, the following scenario may be considered. Cows will act less hungry if they get 1 pound of hay dry matter per 100 pounds of body weight of hay compared to a larger reduction in hay. The remainder of the nutritional needs can be met with corn and concentrates as needed.

Let's compare a typical scenario of allowing cows to voluntarily eat their fill of hay every day (free-choice) to reducing the hay to half their voluntary intake and meeting the remainder of their nutritional needs with corn and other concentrates. Iowa State's BRANDS ration software was used to determine voluntary hay consumption and rations for this comparison. The examples are based on a 1400 pound cow with a body condition score of 5.5 during winter (December and January) temperatures. Two mixed grass legume hays are used, the better quality hay is 12% crude protein and 54.5% TDN, valued at $160 per ton. The lower quality hay is 9.8% crude protein and 49.5% TDN, valued at $140 per ton. Corn priced at $4.50 per bushel and dried distillers grains with solubles (ddgs) priced at $225 per ton are used to replace or supplement any needed energy and protein.

The following tables illustrate what the example cow would voluntarily eat of the two different hays, her gain or loss of weight, the amount of supplementation needed to match voluntary consumption performance, and supplementation needed to meet cow needs and maintain current weight when reducing the hay to half of the voluntary consumption. Tables 6 and 7 are examples of using the better quality hay, Tables 8 and 9 are the lower quality hay. The poor quality hay used in these examples will not meet the nutritional needs during the middle trimester after weaning the calf when her needs are the lowest.

Table 6. Ration comparisons for limit feeding hay to half voluntary consumption for a 1400 pound cow, 5.5 BCS during the middle trimester of pregnancy.

Grass-legume hay 12% C.P., 54.5% TDN	lb as fed/day			lb/day	Feed cost
	Hay	Corn	DDGS	Gain/ loss	$/day
Voluntary consumption	29.4	-	-	0.6	$2.35
Half voluntary consumption & supplement to match voluntary consumption	14.7	8.0	-	0.6	$1.81
Half voluntary consumption and supplement to meet needs with no gain or loss	14.7	5.5	-	0	$1.61

Table 7. Ration comparisons for limit feeding hay to half voluntary consumption for a 1400 pound cow, 5.5 BCS during the third trimester of pregnancy.

Grass legume hay 12% C.P., 54.5% TDN	lbs. as fed/day			lbs./day	Feed cost
	Hay	Corn	DDGS	Gain/ loss	$/day
Voluntary consumption	29.0	-	-	-1.0	$2.32
Voluntary consumption & supplement to meet needs	29.0	1.0	-	0	$2.40
Half voluntary consumption & supplement to match voluntary consumption	14.5	4.5	-	-1.0	$1.52
Half voluntary consumption & supplement to meet needs with no gain or loss	14.5	8.5	-	0	$1.84

Table 8. Ration comparisons for limit feeding hay to half voluntary consumption for a 1400 pound cow, 5.5 BCS during the middle trimester of pregnancy.

Grass-legume hay 9.8% C.P., 49.5% TDN	lbs. as fed/day			lbs./day	Feed cost
	Hay	Corn	DDGS	Gain/ loss	$/day
Voluntary consumption	25.8	-	-	-0.8	$1.80
Voluntary consumption & supplement to meet needs	25.8		0.75	0	$1.89
Half voluntary consumption & supplement to match voluntary consumption	13.0	4.4	-	-0.8	$1.26

Half voluntary consumption & supplement to meet needs with no gain or loss	13.0	5.7	1.0	0	$1.48

Table 9. Ration comparisons for limit feeding hay to half voluntary consumption for a 1400 pound cow, 5.5 BCS during the third trimester of pregnancy.

Grass-legume hay 9.8% C.P., 49.5% TDN	lbs. as fed/day			lbs./day	Feed cost
Grass legume hay 9.8% C.P., 49.5% TDN	Hay	Corn	DDGS	Gain/ loss	$/day
Voluntary consumption	24.4	-	-	-2.9	$1.71
Voluntary consumption & supplement to meet needs	24.4	4.0	0.4	0	$2.07
Half voluntary consumption & supplement to match voluntary consumption	12.2	3.5	0.4	-2.9	$1.18
Half voluntary consumption & supplement to meet needs with no gain or loss	12.2	9.5	0.8	0	$1.98

Severe hay shortage

Under conditions when hay supplies are extremely short, cows could be further forage restricted by feeding them only 5 pounds of hay and meeting the rest of their needs with whole shell corn and or other grains and byproduct feeds to meet energy and protein requirements. Mineral supplementation may need to be adjusted similar to what is fed to feedlot cattle on high grain finishing rations.

The Ohio State University research has demonstrated that cows can be maintained on this low roughage diet without detrimental effects and in instances with high forage and low grain prices, this ration may be more economical. Cows fed this ration will act very hungry even though their nutritional needs are being met so it is extremely important to have good fences and plenty of bunk space. A detailed example of this option can be found here: Corn as an Alternative to Hay for Gestating and Lactating Beef Cows. If choosing this option, a few key points are that corn is fed as whole shelled corn to lower the risk of acidosis and foundering as well as a protein supplement (36%) is provided at 1 lb per head daily which includes an ionophore.

Beef producers should inventory and test their current hay on hand to determine how much hay they could feed the cows per day and work with their nutritionist to determine the most practical and economical way to stretch the hay supply.

Alternative Feeds

There may be access to some other by-product feeds such as bakery waste, vegetable processing by-products (sweet corn waste), cull potatoes, or other similar feeds to help economically stretch hay supplies. When evaluating these potential feeds, it is important to look at how well they will work with your current feed inventory to meet cow needs. Also, don't forget to consider hauling costs, storage loss, and if there are limits to inclusion rates in the ration to prevent digestive problems. A feed may appear to be cheap, but if it does not work well with your existing feeds to meet nutritional needs, or has challenges for storage and feeding, it may not be the best option.

Summary

Producers need to inventory their feedstuffs and compare costs to determine which is the best option for overwintering the cowherd. If feasible, utilize crop residue after harvest to help stretch harvested feed supplies. Remember to be flexible and pencil out the economics to determine which options best fit your situation. Forages, by-products and alternative feeds should be sampled and analyzed for nutrient content. No matter what feedstuffs are used, the goal is to effectively and economically meet cattle nutritional needs.

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