

Crop Residues or Low Quality Hay Combined with Byproducts as a Forage Substitute

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This NebGuide discusses feeding strategies using byproducts and low quality forage combinations that may be used to maintain beef cows during drought conditions, and when forage availability is less abundant and more expensive.

The need for supplemental feed for cow/calf pairs or yearlings grazing summer grass may occur:

- during times of drought when grass production is low,
- during environmental disasters such as hail, fire, or grasshopper infestations,
- or when producers want to increase or maintain their cattle numbers without purchasing or leasing more grass.

During drought, hay tends to be in limited supply and expensive. Maintaining cow productivity while keeping supplemental feed costs low would help producers maintain cattle numbers through times of reduced forage availability. University of Nebraska–Lincoln research has determined the feeding value of low quality roughage combined with byproducts for non-pregnant, non-lactating cows, non-lactating pregnant cows in confinement, and cow/calf pairs or yearlings grazing native range or bromegrass pastures.

Crop residues, such as wheat straw or cornstalks, and very poor quality hay can be economically substituted for grass or medium to high quality hay if their palatability and digestibility can be adequately improved to enhance consumption. (Low quality hay is approximately 46 percent IVDMD and medium to high quality hay is greater than 50 percent IVDMD. IVDMD is a measure similar to TDN.) WDGS and CS, byproducts of ethanol production; and beet

Glossary of Terms

AUM — Animal Unit Month
BCS — Body Condition Score
CS — Condensed Solubles
DM — Dry Matter
hd/d — head per day
in/yr — inches per year
IVDMD — In-vitro Dry Matter Digestibility
TDN — Total Digestible Nutrients
WDGS — Wet Distillers Grains Plus Solubles

pulp, a byproduct of the sugar industry, are highly palatable, nutritious, and can be cost-effective. These byproducts have been successfully mixed with crop residues and poor quality forage to provide an economical feed resource. It can maintain cattle performance, while decreasing dependency on grazed forages and expensive hay.

Mixing and Storing Byproducts and Residues

Most of the WDGS produced in Nebraska are consumed by finishing cattle in feedlots. However, feedlot cattle numbers tend to be lowest in the summer months. This makes WDGS more available to cow/calf producers and generally reduces the cost of the byproduct.

UNL research has indicated that poor quality forage or crop residues can be mixed with ethanol byproducts and successfully stored in bunkers or silage bags for later use. When storing the mixture, it is important to remove as much oxygen as possible to reduce spoilage. To aid in packing the material tightly, the moisture content should be 65-70 percent (30-35 percent DM). The energy, protein,



Figure 1. A cow eats a mixture of 70 percent wheat straw and 30 percent WDGS (DM basis).

and phosphorus content of WDGS is high. Therefore a mixture of 30 percent WDGS and 70 percent low quality roughage (DM basis) has been shown to be sufficient to maintain performance on cows. However, this mixture is only 40 percent moisture and does not pack well for storage. To enhance storage, add water to bring the moisture content to at least 50 percent or mixing at least 50 percent WDGS or CS with a ground roughage source. However, if the goal is to maintain cow weight, producers would need to mix additional roughage to the 50:50 blend at the time of feeding or feed the blend to supplement low quality hay.

Storage and handling costs, as well as shrinkage, should be considered when feeding byproducts and residues. More information on storage can be obtained from Storage of Wet Corn Co-Products from the Nebraska Corn Board. Gestating beef cows in confinement were also limit-fed a fresh mixture of 30:70 WDGS:wheat straw (*Figure 1*) or a fresh 20:20:60 blend of WDGS:sugarbeet pulp:wheat straw (DM basis) mixed daily to reduce handling and labor costs. Cows fed this combination maintained body condition and consumed all offered feed. Additional moisture does appear to improve palatability in fresh mixes.

Preparing the Roughage Source

When limit-feeding confined cattle, the roughage source can be coarsely ground through a 7-inch screen. However, when using byproduct mixtures to replace grazed forage, a finer grind (3-inch screen) improves consumption. As the length of the particle size of the roughage decreases, it is easier to remove the oxygen during the packing process, and sorting will be reduced during the feeding process.

Additionally wheat straw and low quality forage have been mixed with WDGS in a vertical mixer, rather than ground in a tub grinder, with acceptable results.

Cattle Performance on Byproducts and Residues in Confinement

Cattle will readily consume byproducts and poor quality roughage or crop residues, particularly when limit-fed. However, it is only cost-effective if cattle performance is acceptable. Non-lactating, non-pregnant cows were limit fed a 41:59 ratio of WDGS:ground cornstalks or CS:ground cornstalks (17 lb DM/hd/d). A control group was fed *ad libitum* a mixture of brome grass hay, cornstalks, and alfalfa haylage (23 lb DM/hd/d).

All diets contained the same amount of protein and energy. Initial body weight, initial BCS, and final BCS were not different after the 76-day experiment. However, final body weight was higher for the cows fed the WDGS:cornstalk mixture compared to the CS:cornstalk mixture or the control group. These data suggests that non-pregnant, non-lactating cows can maintain or gain weight when limit fed corn distillers byproducts and ground cornstalk residue.

In another experiment, non-lactating pregnant cows were limit fed a 30:70 ratio of WDGS:ground wheat straw as compared to the control group which was limit fed alfalfa hay for 77 days. Both groups were fed to meet the energy requirement in late gestation. Protein was adequate in both diets. Initial and final body weight, initial and final BCS, and calf birth weight were not different between cows fed the two diets.

In a similar experiment, a third treatment was added to include a 20:20:60 mixture of WDGS, beet pulp, and ground wheat straw. Beet pulp, a byproduct of the sugar industry, is readily available from October through February in western Nebraska. Initial body weight and BCS were not different. The alfalfa was of lesser quality than initially estimated, so although the diets were calculated to contain the same energy level, the alfalfa diet was lower than expected.

Cows on the alfalfa treatment gained 66 lbs while the cows fed byproducts and wheat straw gained an average of 154 lbs. The average BCS was 5.8 (scale 1 to 9) at the initiation of the trial. The two groups fed combinations of byproducts and wheat straw had a BCS of 5.8 at the end of the trial. Cows limit-fed alfalfa averaged a BCS of 5.3. The results of these two experiments indicate cows in late gestation will maintain body condition when limit-fed byproducts and crops residues to meet their energy requirements.

Ethanol Byproducts and Poor Quality Roughage as a Replacement for Grazed Forage

At times forage for grazing is limited and confining cattle is unfeasible or may impose health risks to young calves. UNL researchers have studied supplementing a mixture of corn distillers byproduct and low quality hay or

Table I. Example diets for storage in a bunker or silo bag.

<i>Diet with added water to improve storage</i>			<i>Diet using wet distillers grains to increase moisture</i>		
<i>Ingredient</i>	<i>% DM</i>	<i>Actual lbs/ton</i>	<i>Ingredient</i>	<i>% DM</i>	<i>Actual lbs/ton</i>
Ground wheat straw	70	686	Ground cornstalks	30	288
WDGS	30	747	Wet distillers grains	70	1712
Water		567 (68 gallons)			
Mixture dry matter	44		Mixture dry matter	43	

crop residue to grazing cattle in an attempt to replace grazed forage, without removing the cattle from the pasture. Corn distillers byproducts are very palatable and mixing them with low quality forage or crop residues has been shown to increase consumption of low quality roughage. The fiber content of crop residues provides bulk and limits intake in cattle on forage based diets.

In one study, cow/calf pairs grazed native Sandhills range unsupplemented at the recommended stocking rate (0.6 AUM/acre) or double the stocking rate (1.2 AUM/acre).

The third group grazed at 1.2 AUM/acre and was supplemented a 45:55 WDGS:grass hay mix at 50 percent of the estimated forage intake.

A reasonable estimate of forage intake for a cow/calf pair is 2.3 percent of body weight on a dry matter basis. A cow weighing 1,200 lb and her 300 lb nursing calf would consume about 34 lb of dry matter. To replace 17 lb with a byproduct residue mix that is 59 percent dry matter, a producer would feed 29 lb/pair of the mix (17/0.59).

However, in this study, each pound of the 45:55 ratio of WDGS:grass hay mix replaced only 0.22 lb of the grazed forage. This is much lower than the targeted goal of 50 percent forage replacement, and could have potential negative impacts on native range health. The fiber content of the mix may not have been high enough to provide enough bulk to limit grazed forage intake as desired. In a follow up experiment, wheat straw was selected to serve as the roughage source.

Cow/calf pairs then grazed at 0.6 AUM/acre with no supplementation or at 1.2 AUM/acre and received either 50:50, 40:60, or 30:70 WDGS:wheat straw supplementation at 50 percent of the estimated dry matter intake. The 30:70 WDGS:wheat straw treatment almost replaced grazed forage on a 1:1 basis. However, as the amount of WDGS increased in the supplement the amount of replaced grazed forage decreased. For producers with crop residues in close proximity to their cattle, the 30:70 WDGS:residue combination may be a viable option to reduce grazed forage intake.

Some producers aren't close enough to farming regions to economically transport crop residues to their ranches. Therefore, using poor quality hay in place of crop residue to replace grazed forage is of interest. In a study comparing poor quality hay to wheat straw, the control cattle grazed at a stocking rate of 0.7 AUM/acre. Supplemented cattle grazed at 1.32 AUM/acre and received either 40:60

WDGS:wheat straw, or 40:60 or 30:70 WDGS:low quality hay. On average the mixtures were 44 percent of total intake. The results of these studies indicate that a blend of 30:70 WDGS:roughage is the optimum blend to get the most forage replacement. Using this combination of byproduct:forage producers could plan that for every dry matter pound of the combination fed, between 0.5 to 1.0 pounds of forage on a dry matter basis could be replaced.

Cool-season grasses in areas of higher rainfall (> 20 in/yr) may be more suited to the increased grazing pressure and byproduct:residue supplementation. Native warm-season grasses in arid regions (< 20 in/yr rainfall) may be less capable of replacing root reserves under increased grazing pressure and drought conditions as cool-season grasses, and should be monitored closely.

Consumption of the byproduct residue blend while grazing forages may be improved by first offering the more palatable distillers grains alone. After the cattle are familiar with that supplement, the desired blend could be offered either on the ground or in a bunk. Providing the forage replacement on the ground would allow producers to move the cattle around the pasture to improve grazing utilization of the pasture while reducing erosion due to trampling around a single supplement location.

Tables I and II contain example diets for storage or feeding fresh. Distillers grains are high in phosphorus therefore all phosphorus should be removed from the mineral supplement. Calcium is very low in byproducts and residues but adding 18 lb of limestone to each ton of mixed feed will supply the needed calcium. Trace mineralized salt should be offered free choice to cattle in confinement.

Table II. Example diet using WDGS and beet pulp with wheat straw fed fresh.

<i>Ingredient</i>	<i>% DM</i>	<i>Actual lbs/ton</i>
Ground wheat straw	60	658
Wet distillers grains	20	591
Sugar beet pulp	20	751
Mixture dry matter	49	

Summary

The quality and palatability of crop residues or low quality hay can be improved with the addition of by-products from the ethanol or sugar industry to maintain cattle performance and replace more expensive forage resources during times of forage shortage.

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