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G2036

Feed Value of Alternative Crops for Beef Cattle

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Beef cattle feeding options may include field peas, dry edible beans, pumpkins, and sugarbeets.

Several unique crops are grown in western Nebraska primarily for human consumption. However, weather conditions, markets, or other factors may cause them to be unsuitable for human consumption, thus making them economically viable as a feed source for livestock. Because beef production accounts for approximately 50 percent of western Nebraska's economy, the value of these crops for cattle feeding becomes important.

This publication lists the dry matter, crude protein, in vitro dry matter disappearance (similar to Total Digestable Nutrients or TDN), neutral detergent fiber (hemicellulose, cellulose, and lignin content), and acid detergent fiber (cellulose and lignin content) of several selected crops. This information could be used to determine how to include products from these crops in beef cattle rations should the opportunity arise. Crops selected for analysis included field peas, dry edible beans, pumpkins, chicory, whole beets, and beet pulp.

Field Peas

Field peas are becoming increasingly popular in western Nebraska as an alternative to fallow in dryland wheat production rotations. As a legume, peas add nitrogen to the soil, and their early maturity date (July-August) complements fall wheat planting. Field peas can be fed whole or processed with an optimum inclusion level of 20 percent dietary dry matter (DM). They are highly digestible, high in crude protein, and low in fiber *(Table I)*. Research studies have indicated that field peas are palatable, result in no reduction in animal performance, and enhance carcass tenderness.

Dry Edible Beans

Nebraska is one of the nation's leading states of dry edible bean production. Specifically, the North Platte River Valley is known for its consistently high quality bean production, and is responsible for over 85 percent of the Great Northern beans produced in the U.S. Not all beans produced are suitable for human consumption. Broken or discolored beans, as well as frost damaged, diseased, or high moisture beans are available for livestock consumption. Typically, cull beans are used as a binder and protein source in range supplements for grazing cattle. Previous research has shown cull beans can be fed without adversely affecting performance up to 2 percent of diet DM. The adverse effects associated with feeding cull beans is thought to be due to proteins called lectins that interfere with protein digestion and cause watery diarrhea.

Research has indicated the heat required for pelleting is insufficient to denature these proteins. Previously reported crude protein values for beans have ranged from 22-24 percent (DM basis). In the analysis for this report they only ranged from 14.5-16 percent *(Table I)*. Great Northern beans were lower in fiber than pinto beans or black beans while digestibility and crude protein were similar for all beans analyzed. Analysis also was conducted on whole bean plants after frost to determine the feeding value of the whole plant, were it to be harvested for hay. In the whole bean plant analysis, crude protein was much lower and fiber much higher *(Table I)*, but the high percentage of raw beans still would warrant feeding with caution.

Pumpkins

Pumpkins are grown in western Nebraska for decorative purposes in the fall as well as for human consumption. Pumpkins with blemishes typically are discarded and many pumpkins are broken or damaged during harvest, making them unacceptable for market. Furthermore, after Oct. 31, the market for decorative pumpkins plummets and many pumpkins are just left in the fields. Some producers have grazed pumpkin fields in conjunction with cornstalk fields but little is known about the nutritive value of pumpkins for beef cattle. The analysis presented in *Table I* indicates DM digestibility and crude protein to be high (61-71 percent and 14.3 percent DM, respectively) and the fiber to be moderate (25-38 percent DM). Carving pumpkins tended to be lower in dry matter and acid detergent fiber, and have greater digestibility

Table I. Nutrient content of field peas, pumpkins, sugarbeets, beet pulp, dry beans, and chicory

Item[a]	*DM*	*IVDMD*	*CP*	*NDF*	*ADF*
Field Peas	87.0	82.7	15.1	9.5	8.0
Carving Pumpkin	11.9	71.4	14.3	36.8	25.6
Pie Pumpkin	16.5	61.0	14.4	38.6	32.5
Sugarbeet Pulp	26.1	76.1	6.6	45.4	27.4
Whole Sugarbeet Root	23.8	86.8	3.3	15.4	6.7
Whole Sugarbeet Leaves	36.7	65.2	10.9	50.8	24.0
Black Beans	96.9	83.5	15.4	14.3	4.7
Great Northern Beans	98.2	88.0	15.0	7.2	3.7
Pinto Beans	98.3	84.6	14.5	12.0	5.9
Total bean plant (black beans) after frost	90.4	66.3	9.0	38.6	32.4
Chicory Roots	26.1	88.9	3.7	8.6	5.3
Chicory Leaves	17.6	67.3	8.5	23.6	21.4

[a]DM = dry matter; IVDMD = in vitro dry matter disappearance (values are similar to TDN (total digestible nutrients)); CP = crude protein; NDF = neutral detergent fiber; ADF = acid detergent fiber.

than pie pumpkins. The crude protein and neutral detergent fiber were similar for both types of pumpkins. These data suggest pumpkins are a good source of energy and adequate in protein for beef cattle.

Chicory

Chicory is grown primarily for its inulin content. Inulin is a fructose-based sweetener used as a flavoring for coffee or as a coffee substitute. Inulin also has been reported to improve intestinal health in humans. Additionally, the leaves can be added as greens in salads.

Occasionally, chicory is available for livestock consumption. While chicory commonly is added to pet food diets, its use in livestock diets has been more limited. The ground chicory root has been included in growing diets as a replacement for silage at less than 30 percent (DM basis). Results were comparable to using beet pulp to replace silage but with lower intakes, probably due to the palatability of the chicory root. Average quality analysis for both roots and leaves of four varieties of chicory are presented in *Table I*. The chicory root is high in DM digestibility, but very low in crude protein and fiber. The leaves contain moderate DM digestibility, fiber, and adequate crude protein. Typically tops are destroyed and left in the field for organic matter at harvest and unavailable to feed to cattle. However, knowing the feed value of chicory tops is important because occasionally opportunities arise for grazing unharvested fields, so quality analysis of the tops would be meaningful. However, producers should be aware that there is a risk of cattle choking on small uprooted chicory roots.

Whole Sugarbeet Roots, Tops, and Beet Pulp

Nebraska is ranked sixth in U.S. sugarbeet production, and the industry makes a substantial contribution to the western Nebraska economy. At times, environmental conditions prevent harvesting the beets prior to the ground freezing. Questions arise concerning the feed value of grazing unharvested fields of sugarbeets. Beet pulp is a co-product of the sugar production industry, is readily available approximately five months out of the year, and can be stored for later use. It is consistently available whereas whole sugarbeets typically are not. Analyzed whole sugarbeet plants were similar in DM digestibility, crude protein, and acid detergent fiber compared to whole chicory *(Table I)*. The neutral detergent fiber however, was higher in whole sugarbeets. Removal of the sugar increases crude protein and fiber content as compared to the whole root. Beet pulp has a high dry matter digestibility and moderate fiber content with a fairly low crude protein value *(Table I)*. Therefore it is typically included in growing calf rations at less than 30 percent (DM basis). Additional research currently is being conducted on the use of beet pulp in gestating cow and feedlot finishing diets.

Summary

All crops analyzed in this study were highly digestible with low to moderate protein content and could be included in beef cattle diets if they were an economical feed source.

This publication has been peer reviewed.

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Index: Beef
Feeding and Nutrition
Issued August 2010