

# Quality of hay from road right of ways in North Dakota

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*Hay harvested from forages growing in road ditches commonly is used as feed for beef cattle, yet little is documented regarding the nutrient content of ditch hay, the amount of ditch hay harvested or the intended use of ditch hay in North Dakota. Extension agents collected 182 ditch hay samples from 36 counties across North Dakota, and samples were analyzed to reveal factors contributing to variation in nutrient quality and recommendations for balancing quality and quantity of forage harvested. The results of this project revealed factors influencing ditch hay quality and management practices that can be implemented to improve hay quality, while reinforcing the importance of testing forage quality.*

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## Summary

Extension agents engaged producers in 36 counties throughout North Dakota to collect a total of 182 samples of hay harvested from road rights of way (ditch hay). Samples were classified based on the county where the hay was produced, and the cutting date, whether the hay was rained on, type of binding material used, target species for feeding the hay, and whether the hay was going to be fed on the ground, in a hay feeder or as part of a total mixed ration (TMR) were reported. Each hay sample was analyzed for concentrations of dry matter (DM), ash, crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), in vitro organic matter digestibility (IVOMD), calcium (Ca) and phosphorus (P). Samples were bound with plastic twine (40.6 percent), net wrap (40 percent) or sisal twine (19.4 percent). Producers primarily planned to feed ditch

hay to cattle (about 90 percent), with the remaining hay produced for horses, sheep and bison. Producers intended to feed bales using a bale feeder (63.9 percent), directly onto the ground (36.8 percent) or with a TMR (11.6 percent). The mean nutrient content value for samples was 91.4 percent DM, 10.8 percent ash, 8.5 percent CP, 65.1 percent NDF, 52 percent total digestible nutrients (TDN), 0.61 percent Ca and 0.2 percent P. Crude protein content was impacted by the cutting day ( $P < 0.01$ ), with forage harvested early in the year having greater concentrations, compared with those harvested later in the year. Rain during the interval from cutting to baling reduced the TDN content by 2 percentage points ( $P = 0.01$ ). Results highlight the variability observed in ditch hay nutrient content and reinforce the importance of testing individual feeds to ensure appropriate delivery of nutrients to different classes of livestock.

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## Introduction

Hay from road ditches commonly is harvested and used as feed for beef cattle and other livestock. In some cases, the forages being harvested from ditches are very high quality, while in others, the hay is harvested well after dedicated hay fields, and optimizing quality may not be a top priority.

In addition, different types of roads (federal, state, county, township, etc.) may have specific regulations about the time of year forages must be cut and/or removed from the ditches. These and other factors may influence hay quality. Little is known about the nutrient content of ditch hay, the amount of ditch hay harvested or the intended use of ditch hay in North Dakota.

## Experimental Procedures

A total of 182 hay samples were collected from road rights of way and hay lots in 36 counties across North Dakota (Figure 1). Samples were collected from July 15 through Oct. 31, 2015. County Extension agents were critical to the success of this effort, with agents from 29 counties volunteering to aid in collecting and characterizing samples.

Hay samples were composed of hay collected from five or more bales from each sampling location. Samples were collected using a Penn State Forage Probe. Samples were classified based on the county where hay was produced, cutting date, whether hay was rained on, type of binding material used, type of plant species present in the hay and type of road adjacent to the ditches

Additional information regarding the miles of ditch hay baled by

producers, percentage of hay inventory represented by ditch hay, target species for feeding the hay, and whether hay was going to be fed on the ground, in a hay feeder or as part of a total mixed ration also was collected.

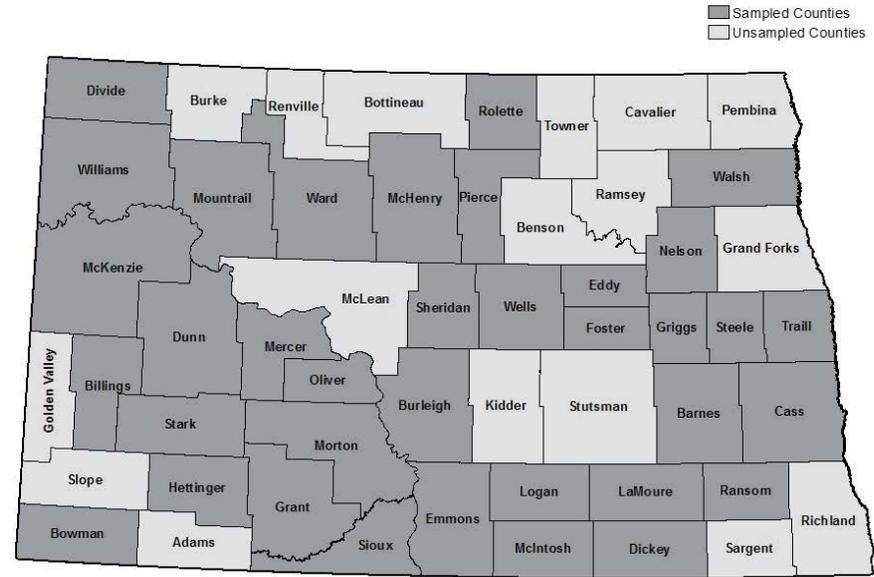
Each hay sample was analyzed for concentrations of dry matter (DM), ash, crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), in vitro organic matter digestibility (IVOMD), calcium (Ca) and phosphorus (P). Following analysis, individual reports of the nutrient content of sampled hay, along with appropriate feeding recommendations, were distributed to participating producers.

Means and standard errors of nutrient content of samples were determined. A general linear model (GLM) and single factor univariate analysis of variance using PROC GLM SAS (Ver. 9.2, SAS 2002) was used to determine the impacts of cutting date, rain, road type and region on nutrient content. Mean separations test was performed using the LSMEANS procedure with the Tukey adjustment.

**Results and Discussion**

Plastic twine (40.6 percent) and net wrap (40 percent) were the bale binding materials most often used, with a smaller proportion of bales being bound with sisal twine (19.4 percent). A majority of the hay sampled was going to be fed to cattle (about 90 percent), with the remaining proportion split among horses, sheep and bison. The feeding method indicated most often was using a bale feeder (63.9 percent), followed by feeding on the ground (36.8 percent) and feeding with a TMR (11.6 percent).

Variability also was observed in the analyzed nutrient content of the forages (Table 1). Some samples tested were extremely high quality,



**Figure 1. Location of North Dakota counties from which road right-of-way hay samples were collected in 2015.**

**Table 1. Nutrient content of ditch hay samples.**

Item	Average	Minimum	Maximum
Dry matter (DM)	91.4	83.7	95.6
Ash	10.8	6.8	37.0
Crude protein (CP)	8.5	5.9	17.0
Neutral det. fiber (NDF)	65.1	35.2	53.6
Total dig. nutrients (TDN)	52.0	34.8	58.5
Calcium (Ca)	0.61	0.28	1.44
Phosphorus (P)	0.20	0.10	0.35

whereas the quality of other samples was poor.

Unpaved roads in several parts of North Dakota are experiencing heavy traffic related to oil-field activities, and dust has the opportunity to collect on standing and cut forages from ditches adjacent to these heavily used roads. Dust contamination was noted in several of the samples taken for the core oil-field counties, with ash content (essentially inert, indigestible material) reaching a maximal value of 37 percent, compared with our average value of 10.8 percent.

The cutting date of samples ranged from June 10 to Sept. 10. The concentration of crude protein in samples was impacted by the cutting date, with forage harvested early in the year having greater concentrations of crude protein, compared with those harvested later in the year (Figure 2). This trend was expected because the protein content of standing forages decreases with plant maturity during the course of the growing season.

Across North Dakota, road ditches consist of cool-season introduced grass species, the most

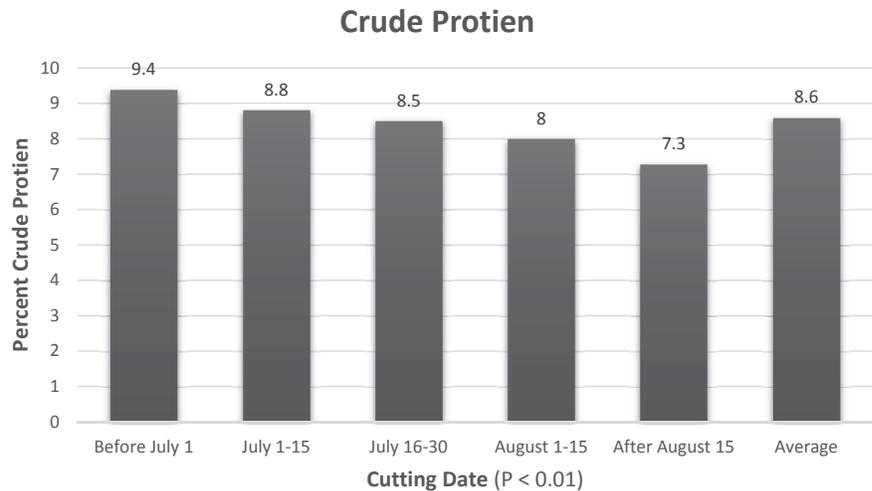
common being smooth brome grass. These species initiate growth early in the spring and reach peak production in early July. To achieve the best combination of quality and quantity, this would be the optimal time to harvest; however, specific regulations regarding the timing of ditch hay harvest for roads under certain jurisdictions may prohibit harvesting forage of optimum quality.

Approximately 25 percent of the samples submitted were rained on during the interval from cutting to baling. The number of days the forages were wet in the swath ranges from one-half a day to more than 14 days, with four days being the average. Rain was associated with an increased ash content, and the TDN content of samples that had been rained on was 2 points less than those that had not had rain fall on them.

To understand the variation in forage quality across the state, samples were divided to represent eastern and western regions. The region did not impact the protein content of the forages, but acid detergent fiber and TDN were impacted.

Samples from the eastern region had greater TDN (via reduced ADF), compared with samples from the western region. Variations in soil type, temperature, moisture and species composition between regions all likely contributed to the differences observed.

Individual reports of the nutrient content of sampled hay allowed producers to incorporate the hay



**Figure 2. Concentrations of crude protein in ditch hay samples by cutting date**

into a ration while ensuring the nutritional requirement of their livestock were being met. In addition, these producers have an increased awareness of factors influencing hay quality and management practices that can be implemented to improve hay quality.

The results of this project allowed us to understand the variation in quality of ditch hay within a single year's harvest and factors contributing to that variation. The largest factor influencing hay quality is cutting date. To achieve the best combination of quality and quantity, early July is the optimal time to harvest. The variation in the results reinforces the importance of testing nutrient contents of individual feeds to ensure appropriate delivery of nutrients to different classes of livestock.

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