Quality of Hay from CRP Lands in North Dakota

Kevin Sedivec and Charlie Soiseth

The Conservation Reserve Program (CRP), contained in the 1985 Food Security Act, provided incentives to remove highly erodible land from crop production and place it under permanent vegetative cover. Approximately 36.3 million acres of land were enrolled in CRP nationwide, of which approximately 2.9 million acres are in North Dakota (United States Department of Agriculture 1996).

The U.S. Secretary of Agriculture opened most of North Dakota's CRP lands to emergency haying and grazing due to low cattle prices, high feed costs, and hay shortages in 1996. Drought has historically driven the emergency release program of CRP lands for haying, however, 1996 releases were somewhat different. Short supplies of corn and barley on a global perspective lead to high feed costs that became unaffordable to many ranchers due to low cattle prices. The harsh winter of 1995–1996 and drier conditions in the first half of 1996 led to above normal usage of harvested forages, causing a hay shortage in much of the western states. Conservation Reserve Program lands became available for grazing 1 May and for haying 15 July, 1996. Although few producers took advantage of the grazing option (3 percent of North Dakota' s CRP lands), a large number of producers hayed CRP lands in North Dakota. Over 7,770 CRP contracts in North Dakota were hayed in 1996. A total 646,701 acres of CRP were hayed, comprising almost 23 percent of the state' s total CRP acres.

Many livestock producers expressed concern about the quality of CRP hay cut after mid July. Historically, a 15 July date has been used to allow emergency haying of CRP lands and other set-aside lands. Although no specific law was passed requiring emergency haying on set-aside lands not hayed prior to 15 July, concerned wildlife groups requested a haying date that minimized damage of ground nesting birds and young fledglings. Haying after 15 July was most often chosen to minimize this potentially negative impact on ground nesting birds and maintain nesting cover for the next year (Hays and Farmer 1990).

Although the impacts of late season emergency haying of CRP lands and other set-aside lands on ground nesting birds have been documented (Renner et al. 1995, Luttschwager et al. 1994, and Hays and Farmer 1990), the forage quality of hay from these CRP lands harvested after mid July are limited un-

CRP fields in North Dakota. Fore front,—grass dominated; background—alfalfa dominated.

CRP land in hay production—1996.

Sharp tailed grouse nesting.

less assumptions are made. For instance, we know the nutrient content of alfalfa, smooth bromegrass, and many wheatgrasses at specified physiological growth phases. However, when combinations of three or more of these plants are seeded in a mixture and allowed to remain idle for five to 10 years, it becomes difficult to assume the forage value of the stand when field-to-field alfalfa composition differs and haying history is not accounted.

The Program has been extended for 10 to 15 additional years in the 1996 Farm Bill, creating a need for determining the feed value of CRP fields hayed after mid July. Once again, CRP lands in North Dakota were released for emergency haying in 1997. The purpose of this field project was to determine the nutrient content of CRP hay harvested after 15 July from previously hayed and non-hayed sites.

Hay samples were collected from 103 CRP fields in North Dakota using county extension agents, area livestock specialists, and the state rangeland specialist in July and August of 1996. Samples were collected from 20 counties (Fig. 1). Program hay samples were collected from fields comprised of domestic cool-season grasses and alfalfa. The cool-season grasses included smooth bromegrass, intermediate wheatgrass, tall wheatgrass, crested wheatgrass, and slender wheatgrass. Each CRP hay sample included one or more cool-season grasses and alfalfa.

CRP hay samples were composed of hay from five or more bales within each field. Samples were collected using a Penn State Forage Probe (Holland and Kezar 1990). All fields were classified as having greater or less than 33 percent alfalfa (most fields in North Dakota had either 30 percent or less alfalfa in the CRP stand or appeared to be greater than 40 percent) in the plant mix by weight. Each field was further subdivided as 1) having been hayed since 1993, or 2) hayed prior to 1993. The year 1993 was used as our basis for haying history because all of North Dakota was open for emergency haying during that year. Only a limited number of counties was open for haying in 1994 and 1995, while all of North Dakota was open in 1996. The mean haying date of CRP fields represented in this project was 20 July, ranging from 15 July to 2 August. Stage of physiological growth was seed-set to mature for all grasses and full bloom for alfalfa.

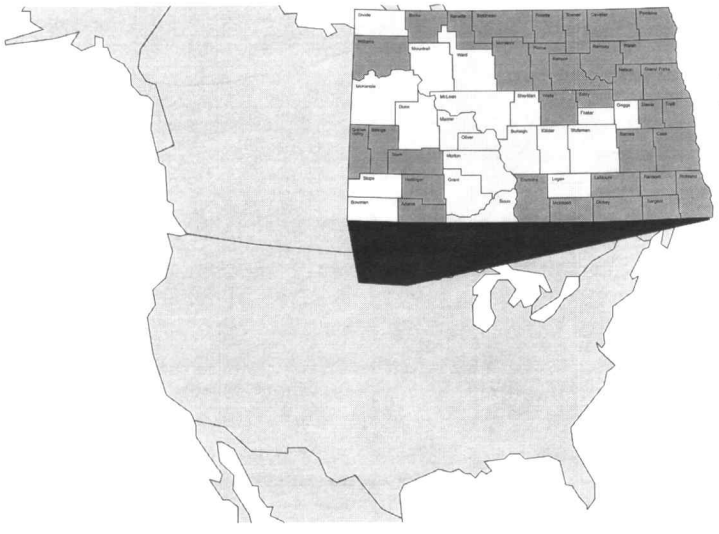

Fig. 1. *Location of North Dakota counties from which conservation reserve program hay samples were collected in 1996*

All CRP hay samples were analyzed for percent crude protein and acid detergent fiber. All samples were oven dried at 60° C for 72 hours, ground through a 1-mm screen using a Wiley mill, and divided into two replicate portions. Percent acid detergent fiber was determined using procedures defined by the Association of Official Analytical Chemists (AOAC 1990) and percent crude protein content was determined using a Kjeldahl Auto System II (AOAC 1990).

Means and standard errors for field differences by percent alfalfa and haying history were determined. Multi-response permutation procedures (Biondini et al. 1988) were used to conduct a means separation test between CRP hay types. Although hay samples from a given field were randomly selected, not all CRP fields in North Dakota had an equal chance of being selected in the trial. The sample fields tended to be clumped (see Fig. 1) in terms of location in North Dakota and a large degree of variability existed among CRP fields in North Dakota, creating the need for a non-parametric statistic test.

Most ranchers and livestock producers attempt to balance a feed ration based on crude protein content and acid detergent fiber. Total digestible nutrient content is calculated and derived by the best fit equation using crude protein and acid detergent fiber and an intercept adjustment term for forage class. The crude protein value is a combination of microbial protein and undegraded intake protein, with adequate levels needed to maintain livestock performance and production. Acid detergent fiber is classified as the highly indigestible plant material in a forage and comprises cellulose, lignin, and insoluble ash. The lower the acid detergent fiber, the more feed an animal can digest. Thus, a low acid detergent fiber percentage and high crude protein level is desired. A short summary of the crude protein and acid detergent fiber results will follow to best illustrate some nutrient content values of the CRP hay.

Crude Protein

Crude protein content ranged from 6.9 to 19.3 percent with a mean of 10.8 percent (SE = 0.45 percent) from fields with greater than 33 percent alfalfa. Crude protein ranged from 4.9 to 12.6 percent with a mean of 8.1 percent (SE = 0.19 percent) from fields with less than 33 percent alfalfa (Table 1).

Crude protein content ranged from 6.4 to 19.3 percent with a mean of 10.1 percent (SE = 0.39 percent) from fields

Table 1. Mean percent crude protein content of Conservation Reserve Program hay with different alfalfa compositions and haying history in North Dakota during 1996.

Alfalfa Composition	Haying History: Prior to 1993 (>3 yrs)	Haying History: During or after 1993 ≤ 3 yrs)	Total
<33%	n = 41 7.7+ 0.3	n = 23 8.6 + 0.5	n = 64 8.1 + 0.3
≥33%	n = 15 9.8 + 0.7	n = 24 11.5 + 0.9	n = 39 10.8 + 0.7
Total	n = 56 8.3 + 0.4	n = 47 10.1 + 0.6	n = 103 9.3 + 0.5

hayed since 1993. Crude protein content ranged from 4.9 to 16.6 percent with a mean of 8.3 percent (SE=0.27 percent) from fields hayed prior to 1993 (Table 1).

Acid Detergent Fiber Content

Acid detergent fiber content ranged from 35.3 to 50.5 percent with a mean of 43.8 percent (SE=0.54 percent) from fields with greater than 33 percent alfalfa. Acid detergent fiber content ranged from 38.9 to 57.5 percent with a mean of 45.1 percent (SE=0.39 percent) from fields with less than 33 percent alfalfa (Table 2).

Acid detergent fiber content ranged from 35.3 to 50.5 percent with a mean of 43.6 percent (SE = 0.47 percent) from fields hayed since 1993. Acid detergent fiber content ranged from 40.1 to 57.5 percent with a mean of 45.4 percent (SE = 0.42 percent) from fields hayed prior to 1993 (Table 2).

Table 2. Mean percent acid detergent fiber content of Conservation Reserve Program hay with different alfalfa compositions and haying history in North Dakota during 1996.

	Haying History		
Alfalfa Composition	Prior to 1993 (>3 yrs)	During or after 1993 ≤ 3 yrs)	Total
<33%	n = 41 45.8 + 1.0	n = 23 43.9 + 0.8	n = 64 45.1 + 0.6
≥33%	n = 15 44.4 + 0.7	n = 24 43.4 + 0.9	n = 39 43.8 + 0.9
Total	n = 56 45.4 + 0.7	n = 47 43.8 + 0.8	n = 103 44.5 + 0.8

Discussion

Nutritional quality of CRP hay samples differed dramatically among fields. However, when hay samples were separated by amount of alfalfa present and history of previous haying, more consistent results were achieved. Alfalfa, even in the full bloom stage, will have a higher crude protein content and lower acid detergent fiber value than most tame or native grasses. Those CRP hay samples with greater than 33 percent alfalfa had greater percent crude protein content than hay samples with less than 33 percent alfalfa, as suggested by Heath et al. (1985) and Ensminger et al. (1990). However, we did not see a difference in percent acid detergent fiber content based on percent alfalfa composition as would be expected.

History of previous haying was important in percent crude protein and acid detergent fiber content of hay samples. Those fields hayed within three years (up to two complete growing seasons following the hayed year) had a greater percent crude protein and lower acid detergent fiber content than fields not hayed within three years. The build-up of standing litter or previous years weathered dead plant tissue reduced crude protein content and increased acid detergent fiber content of hayed material. Morrison (1948) reported crude protein content of weathered grass hay, bromegrass hay, and alfalfa straw at 3.3, 3.4, and 8.8 percent, respectively. Ensminger et al. (1990) reported crude protein content of grass and alfalfa straw at 3.9 and 9.0 percent, respectively. These data would indicate that CRP fields hayed using a three-year rotation or less would produce a higher quality hay than fields hayed using a four-year or greater rotation.

Hay samples from CRP fields with greater than 33 percent alfalfa and hayed since 1993 had a higher crude protein content than those fields not hayed since 1993, however, acid detergent fiber did not differ. Hay samples from CRP fields with less than 33 percent alfalfa and hayed since 1993 had a higher crude protein and acid detergent fiber content than those fields not hayed since 1993.

CRP fields with greater than 33 percent alfalfa and hayed periodically will provide higher nutritional quality hay than fields with minimal alfalfa and lacking a recent history of haying. Periodic haying will not only improve the quality of CRP hay but may also improve nesting success of ducks (Luttschwager et al. 1994, Renner et al. 1995). Haying CRP fields prior to grass maturity and full-bloom alfalfa (prior to 15 July) would dramatically increase crude protein content and lower the acid detergent fiber value of hay, but increased nest destruction and fledgling mortality may be observed. If CRP fields are converted to hay fields after contract terminations, haying should be conducted by late June to increase nutritional quality.

Literature Cited

AC. 1990. Official Methods of Analysis (15th ed.). Association of Official Analytical Chemists, Arlington, Virg.

Biondini, M.E., P.W. Mielke, and K.J. Berry. 1988. Data-dependent permutation techniques for the analysis of ecological data. Vegetatio 75:161–168.

Ensminger, M.E., J.E. Oldfield, and W.W. Heinemann. 1990. Feeds and nutrition (2nd ed.). Ensminger Publ. Comp., Clovis Calif.

Hays, R.L. and A.H. Farmer. 1990. Effects of the CRP on wildlife habitat: emergency haying in the midwest and pine plantings in the southeast. Trans. 55th N.A. Wildl. and Nat. Res. Conf. Wildlife Management Institute, Wash. D.C. pp. 30–39.–

Heath, M.E., R.F. Barnes, and D.S. Metcalfe. 1985. Forages, the science of grassland agriculture (4th ed.). Iowa State University Press, Ames. Iowa.

Holland, C. and W. Kezar. 1990. Pioneer forage manual: a nutritional guide. Pioneer Hi-Bred International, Inc., Des Moines Iowa..

Luttschwager, K.A., K.F. Higgins, and J.A. Jenks. 1994. Effects of emergency haying of duck nesting in conservation reserve program fields, South Dakota. Wild. Soc. Bull. 22:403–408.

Morrison, F.B. 1948. Feeds and Feeding, 21st Ed. The Morrison Publishing Company, Ithaca, NY. 1207 pp.

Renner, R.W., R.E. Reynolds, and B.D.J. Batt. 1995. The impact of haying conservation reserve program lands on productivity of ducks nesting in the prairie pothole region of North and South Dakota. Trans. 60th N.A. Wildl. and Nat. Res. Conf. Wildlife Management Institute, Wash. D.C. pp. 221–229.

United States Department of Agriculture. 1996. USDA 1996 Farm Bill conservation provisions: summary. USDA, Washington, D.C. 4 p.

Authors are extension rangeland specialist, Animal and Range Sciences Department, North Dakota State University, Fargo, North Dakota 58105 and county extension agent, North Dakota State University, Sioux County, Fort Yates, North Dakota 58538.

We acknowledge Carmel Miller, Elroy Haadem, Keith Brown, Robert Theis, Kurt Froelich, Tim Becker, Joseph Gross, Randy Gaebe, Jackie Buckley, Dale Naze, Patrick Carpentier, Bruce Schmidt, Richard Schmidt, Kent Alderin, Sarah Norby, James Henessy, Dennis Egge, and John Dhuyvetter for collecting forage samples. Financial support was provided by the North Dakota State University Animal and Range Sciences Department and North Dakota State University Extension Service.