The Effects of Nitrogen Fertilization and Time of Year On The Quality and Quantity of Soft Red Winter Wheat Forage

Arkansas Animal Science Department Report
December 2001.

University of Arkansas
Research Series 488

The Effects of Nitrogen Fertilization and Time of Year On The Quality and Quantity of Soft Red Winter Wheat Forage

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Story in Brief

The quality and quantity of soft red winter wheat forage, fertilized with different levels of nitrogen were determined at different times of the year in pasture clippings and masticate samples. The quality of the wheat forage was determined by measuring organic matter (OM), crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), and in-vitro organic matter disappearance (IVOMD). The quantity of forage was estimated by clipping all vegetative (alive and dead) forage within four -m^2 frames selected from random locations throughout each site. The percent dry matter decreased ($P < 0.01$) with the addition of nitrogen fertilization but there were no differences in dry matter yield due to nitrogen fertilization. There were no differences in the quality indicators (OM, CP, ADF, NDF or IVOMD) due to nitrogen fertilization except CP increased ($P < 0.01$) as nitrogen fertilization increased. All quality indicators were lower ($P < 0.01$) in the masticate samples than in the pasture clippings. Percent dry matter changed ($P < 0.01$) at different times of the year. Forage dry matter yield increased ($P < 0.01$) during the year. There was a highly significant effect ($P < 0.01$) on forage quality indicators due to time of the year in both pasture clippings and masticate samples. Pasture clippings or masticate samples were not affected by time of year. Forage quantity increased but forage quality decreased from December through March.

Introduction

Soft red winter wheat (*Triticum aestivum* L.) is an important crop in Arkansas with over a million acres planted each year. Daniels et al. (2000b) reported that stocker steers make excellent body weight gains when grazing soft red winter wheat forage from October through April. They also observed that if cattle are removed from the wheat forage by March 1, grazing of the forage does not decrease wheat grain production. Nitrogen fertilization has been shown to increase forage yields (Collins et al., 1990) while having no effect on concentrations of neutral detergent fiber (NDF) or acid detergent fiber (ADF). Collins and Balasko (1981) reported an increase in the digestibility of forage with increased nitrogen fertilization. However, Saibro et al. (1978) and Daniels et al. (2000a) reported that nitrogen fertilization had no effect on digestibility of forage.

Therefore, the objective of this study was to evaluate the quality and quantity of soft red winter wheat forage fertilized with different levels of nitrogen fertilization in pasture clippings and masticate samples taken from December through March.

Experimental Procedures

Delta King 9027 cultivar of soft red winter wheat was seeded in a 110 x 130 feet plot at the rate of 120 lb per acre into a prepared seedbed having no preliminary addition of fertilizer on October 1, 1999. The plot was divided into nine 10 feet by 100 feet subplots having 3 feet alleys separating each subplot. Subplots received either 0 lb N (control), 34 lb N or 68 lb N per acre on November 11, 1999 in the form of ammonium nitrate. The quantity of forage (alive and dead) was estimated by clipping forage in four -m^2 frames selected at random in each sub-plot on December 8, 1999, January 5, 2000, February 4, 2000, and March 1 and 28, 2000. Forage quality, using organic matter (OM, crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF) and in-vitro organic matter disappearance as indicators of quality, was determined on clipped pasture and rumen masticate samples taken on December 8, 1999, January 5, 2000, February 4, 2000 and March 1 and 28, 2000. Masticate samples were obtained using three ruminally fistulated steers fasted for 24 hours prior to sampling. Rumen contents were evacuated, and steers were allowed to graze the wheat forage for approximately 30 to 45 minutes before masticate samples were removed. Statistical analysis were conducted using PROC MIXED of SAS (SAS Inst. Inc, Cary, NC) for a split-plot design.

Results and Discussion

The effects of nitrogen fertilization on the percent dry matter and the pounds of dry matter per acre of soft red winter wheat forage are given in Table 1. The percent of dry matter of wheat forage decreased ($P < 0.01$) with an increase in

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nitrogen fertilization but there was no difference in the pounds of dry matter per acre due to nitrogen fertilization.

The effects of nitrogen fertilization on the quality of wheat forage in pasture and masticate samples are given in Table 2. In pasture samples, CP increased ($P < 0.01$) as nitrogen fertilization increased. However, nitrogen fertilization did not affect OM, IVOMD, NDF or ADF in pasture samples nor did it affect OM, CP, IVOMD, NDF or ADF in masticate samples.

The effects of time of year on the percent dry matter and pounds of dry matter per acre of wheat forage are given in Table 3. Percent dry matter and pounds of dry matter per acre increased ($P < 0.01$) from December 8, 1999 through March 28, 2000. This was due to the wheat becoming more mature. The effects of time of the year on the quality of wheat forage in pasture clippings and masticate samples are given in Table 4. Organic matter, NDF and ADF increased ($P < 0.01$) from December 8, 1999 through March 28, 2000, whereas CP and IVOMD decreased during the time period in pasture clippings. Organic matter in masticate samples of wheat forage increased ($P < 0.01$) from December 8, 1999 through March 28, 2000 but CP decreased ($P < 0.01$) during this time period. There were no differences due to time of year of masticate forage sample for IVOMD, ADF or NDF.

Implications

Nitrogen fertilization of soft red winter wheat forage increased CP and decreased DM concentration but had no effect on IVOMD, ADF or NDF. Time of year and associated maturity effects cause fiber concentrations of wheat forage to increase while CP and IVOMD decreased. These data provide a guide of the plant maturity effect on quality of the wheat forage.

Literature Cited

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Table 1. The effects of nitrogen fertilization on percent dry matter and pounds of dry matter per acre of wheat forage.

	Nitrogen Level			
Variable	0	34 lb/acre	68 lb/acre	P–value
Percent dry matter	22.22	21.09	20.82	<0.01
Dry matter yield, lb/acre	3056	3445	3298	NS

Table 2. The effects of nitrogen fertilization on the quality of wheat forage in pasture and masticate samples.

		Nitrogen Level			
Sample	Variable	0	34 lb/acre	68 lb/acre	P-Value
Pasture[a]	OM	90.63	90.21	90.62	NS
	CP	19.90	22.02	23.15	<0.01
	IVOMD	77.86	77.03	78.83	NS
	NDF	49.88	50.82	49.46	NS
	ADF	24.00	24.50	23.53	NS
Masticate	OM	81.85	79.82	79.59	NS
	CP	23.11	25.02	23.72	NS
	IVOMD	57.98	56.15	58.64	NS
	NDF	62.21	66.25	64.40	NS
	ADF	33.79	33.00	36.61	NS

[a] Means between sampling techniques for each variable differ (P < 0.01).
NS Means within rows are not different (P > 0.05).

Table 3. The effects of time of year on percent dry matter and pounds of dry matter per acre of wheat forage.

	Time of year					
Variable	Dec 8	Jan 5	Feb 4	Mar 1	Mar 28	P-value
Percent dry matter	17.29	19.29	25.76	24.12	20.45	<0.01
Dry matter yield lb/acre	2215	2787	2988	3682	4690	<0.01

Table 4. The effects of time of year on the quality of wheat forage in pasture and masticate samples.

		Time of year					
Sample	Variable	Dec 8	Jan 5	Feb 4	Mar 1	Mar 28	P-value
				%			
Pasture	OM	89.00	89.49	90.84	90.65	92.46	<0.01
	CP	30.57	23.90	20.55	19.59	13.84	<0.01
	IVOMD	86.02	83.01	79.21	79.86	61.43	<0.01
	NDF	44.37	46.75	45.32	52.61	61.21	<0.01
	ADF	21.77	21.74	20.85	24.75	30.94	<0.01
Masticate	OM	76.31	77.60	83.32	75.50	87.38	<0.01
	CP	30.63	24.98	20.27	24.25	19.63	<0.01
	IVOMD	53.97	53.64	63.21	54.64	62.49	NS
	NDF	54.75	73.27	60.70	66.84	65.87	NS
	ADF	35.16	40.59	30.23	38.87	34.16	NS