CHANGES IN PROTEIN AND NON-PROTEIN NITROGEN IN SUDAN HYBRIDS AS CUT FOR HAYLAGE

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ABSTRACT

Fifty samples of sudan X sorghum (Sordan 67) and a sudan hybrid (Trudan 2) were obtained as cut, at one, two, and three days of field drying for haylage. Samples cut at 6 a.m., 11 a.m., 4 p.m., and 9 p.m. showed that ammonia, nitrates, and nitrites were highest at 6 a.m. and 9 p.m. and lowest at 4 p.m. Samples taken before and after rains indicated increases in ammonia, non-protein nitrogen, nitrates, and especially in nitrites after rains. Curing for haylage did not result in great changes in nitrogenous constituents during 3 days of drying during fair weather.

INTRODUCTION

Certain sudan and sudan X sorghum hybrids have become popular supplemental forage crops because of their drouth and hot weather resistance, as well as their high yields. These forages are sometimes cut and wilted to about half dryness (40 to 50% H_2O). This partially dried material, drier than silage and more moist than hay, is called haylage. Such material is sometimes stored in oxygen-limited storage units called Harvestores.

When properly grown, harvested, and stored, these forages provide good quality feed. Under some conditions it was observed that animals would not consume the forage well. Some preliminary analyses indicated high non-protein nitrogen contents of such forages. Because of these observations, the following research was conducted in order to study changes in nitrogen compounds in the hybrids as the plants were cut and dried for haylage.

EXPERIMENTAL PROCEDURE

Hybrid sudans Trudan 2, a line cross of sudans, and Sordan 67, a sorghum X sudan cross were furnished by the Northrup-King Company. The land was prepared conventionally, with 175 lb. of ammonium nitrate (33 1/3% N) and 45 lb. of 0-46-0 superphosphate applied per acre. For these samplings 4 replications were used in planting areas.

The plants for most of the analyses, except for the maturity study, were cut on July 5 and July 11, 1968. Cuttings were made at 6 a.m., 11 a.m., 4 p.m. and 9 p.m. in order to study nitrogen changes at different daylight hours. Adjacent areas were left standing for sampling at different stages of maturity. Samples were frozen immediately and sent to Harris Laboratory for conventional AOAC analyses, except for nitrites which were analyzed by a modification of a common method of determining nitrites in water.

RESULTS

Changes in the nitrogenous constituents are summarized in Tables 1 and 2.

Table 1. Nitrogen Percentages at Times of Day Cutting of Sordan 67.

Time Cut	Total N	Ammonia N	Non-Protein N	Nitrates (as KNO3)	Nitrites (as $NaNo_2$)
	(%)				(ppm)
6 a.m.	3.45	.03	1.5	2.3	43
11 a.m.	3.64	.03	1.6	2.7	29
4 p.m.	3.16	.02	1.4	1.5	9
9 p.m.	3.37	.02	1.4	1.6	14

Analysis of the total nitrogen indicated that there were significant differences (P.05) at different times of day cutting. Ammonia nitrogen changes were not significantly influenced by time of day cutting. Non-protein nitrogen and nitrate changes approached significance. Changes in nitrites were significant (P.05). The means of these nitrogen constituents tended to be high in the morning and lowest, usually at 4 p.m.

Table 2 shows the means of the nitrogen compounds as influenced by time of day cutting Trudan 2.

Table 2. Nitrogen Percentages at Times of Day Cutting of Trudan 2.

Time cut	Total N	Ammonia N	Non-Protein N	Nitrates (as KMO3)	Nitrites (as $NaNO_2$)
	(%)				(ppm)
6 a.m.	3.54	.03	1.5	2.9	32
11 a.m.	3.44	.02	1.4	2.9	27
4 p.m.	3.48	.02	1.4	2.5	33
9 p.m.	3.61	.02	1.5	2.9	47

The changes due to time of day cutting were not as pronounced with Trudan 2 as with Sordan 67. However, the means tended to be low at 11 a.m. and 4 p.m. and high either at 6 a.m. or 9 p.m., or both. It appears reasonable that nitrogen metabolism would be higher during daytime. Vanecko and Varner found that nitrogen as N^{15} nitrate was reduced to amino nitrogen by intact leaves in both light and darkness, but the rate of reduction was much faster during daylight. Their results indicate that nitrite was converted to ammonia.

According to Doby, the major part of nitrates in plants is in the stems and leaves. Nitrites change quite rapidly and nitrite disappearance is especially rapid. Nitrates are converted to nitrites by the enzyme nitrate reductase, and finally to

ammonia by several steps. Nitrates and nitrites are used up in formation of plant protein more rapidly during the day and less rapidly at night when photosynthesis from the sun is not present.

During the curing process for haylage, there was some rain on the cut plants in 3 rains of .04, .01, and .63 inches. Samplings before and after the rains were analyzed. Means are presented in Tables 3 and 4.

Table 3. Effects of Rain on Sudan (Sordan 67) Nitrogen

Time	Total N	Ammonia N	Non-Protein N	Nitrates	Nitrites
	(%)				(ppm)
Before rain	3.9	.01	1.6	2.7	14
After rain	4.2	.04	2.0	3.5	95

Table 4 shows the effect of rain on Trudan 2.

Table 4. Effects of Rain on Trudan 2 Nitrogen

Time	Total N	Ammonia N	Non-Protein N	Nitrates	Nitrites
	(%)				(ppm)
Before rain	3.6	.01	1.3	1.9	10
After rain	3.8	.03	1.4	3.2	95

There was a highly significant effect of rains in increasing the ammonia nitrogen 3 and 4 times the level of before the rains. Total nitrogen and non-protein nitrogen values did not appear to increase much from rains. Nitrate and nitrite increases from rains were highly significant (P.01).

The sudan hybrids were sampled for protein analyses at different stages of maturity at increasing plant heights. These data are presented in Tables 5 and 6.

Table 5. Protein Changes with Maturity of Sordan 67

Date	Crude Protein	Plant Height
	(%)	(in)
First Cutting:		
July 8	25.0	27
July 29	14.5	44
Aug. 26	10.6	65
Second Cutting:		
Sept. 4	20.0	25
Sept. 24	13.4	38

The protein content as shown in Table 5, decreased considerably with increased plant growth and maturity. Table 6 shows a similar trend for Trudan 2.

Table 6. Protein Changes with Maturity of Trudan 2

Date	Crude Protein	Plant Height
	(%)	(in)
First Cutting:		
July 8	24.1	25
July 29	16.0	43
Aug. 19	9.6	58
Second Cutting:		
Sept. 4	17.5	26
Sept. 24	13.0	39

Because of the reduction in protein, primarily, common recommendations are made to cut these hybrids for haylage at not over 30 inches in height.

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