

1980

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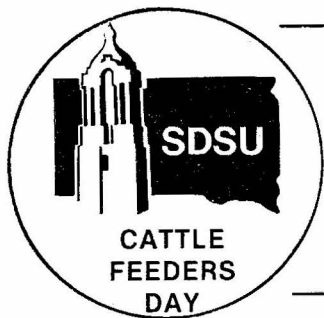
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Recommended Citation

Chisholm, T. S.; Kamstra, L. D.; and Vigil, F. R., "Dry Matter and Nutrient Losses for Large Round Hay Bales Stored Outside" (1980). *South Dakota Cattle Feeders Field Day Proceedings and Research Reports, 1980*. Paper 5.
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DRY MATTER AND NUTRIENT LOSSES FOR LARGE ROUND HAY BALES STORED OUTSIDE

T.S. Chisholm, L.D. Kamstra and F.R. Vigil
Department of Animal Science Report
CATTLE 80-4

Summary

End-to-end storage with space between rows of large hay bales provided for the best storage as compared to individual spaced bales or pyramid stacking. Dry matter losses were 10.3, 4.0 and 0.8% for the pyramid, individual and end-to-end bale arrangement, respectively.

Introduction

Large round bales have become a commonly used means for packaging hay. Some questions still remain, however, concerning the best techniques for handling, storing and feeding these packages.

In this study, three different arrangements of bales were used to compare storage characteristics over a 1-year period.

Materials and Methods

On August 18, 1977, thirty-three large round bales of mixed prairie hay were placed in storage for 1 year. Eight bales were placed on the ground with an 18-inch space between bales on all sides (figure 1). Five bales were placed with ends directly against the opposite bale with an 18-inch space between rows (figure 2). Twenty bales were placed in a pyramid stack with 12 bales on the bottom layer, six bales on the second layer and two bales at the top. Regardless of arrangement, all bales were placed with the ends in a vertical position. The storage area was located at the Pasture Research Center near Faulkton, South Dakota, on a well-drained hillside. Annual precipitation in the area averages 19.05 inches. The precipitation during the study period was 22.18 inches.

Five bales of the individual, two end-to-end storage bales and six bales of the pyramid were sampled for analysis of moisture, crude protein and in vitro dry matter digestibility (IVDMD) initially and after storage. Dry matter loss after 1 year of storage was also determined by initial and final bale weight and moisture core samples.

Results and Discussion

Bales placed individually on the ground were exposed to rain on open ends and required a greater storage area than other forms of arrangement (figure 1). Bales placed end-to-end in separated rows appeared to allow for best storage, although they required more storage space than the pyramid stack (figures 2 and 3). Approximately 500 to 600 tons of hay can be stored per acre using the

end-to-end arrangement. The pyramid arrangement provided for the most efficient use of storage space but held excessive amounts of moisture at bale contact points. The excessive moisture absorption caused excessive deterioration of the large round bales as is shown in figure 4. Dry matter losses were 10.3, 4.0 and 0.8% for the pyramid, individual and end-to-end bale arrangement, respectively (table 1). Little difference was noted in crude protein between the three bale arrangements, but in vitro digestibility appeared to be lowered by storage in the pyramid (table 1).

It is recommended that the end-to-end storage of hay bales would provide for the best storage of large hay bales, provided that the bales are placed in a location having good surface and subsurface drainage. Bales should be placed perpendicular to contour such that the bales do not provide a dam for surface water.

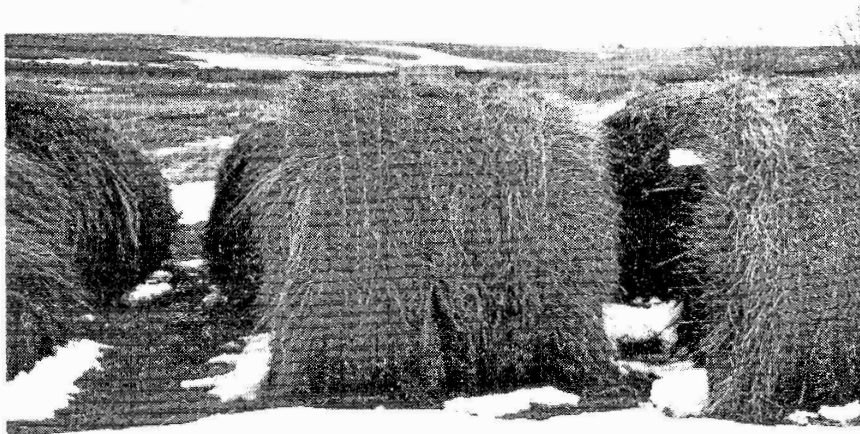


Figure 1. Individual large round bale in storage.

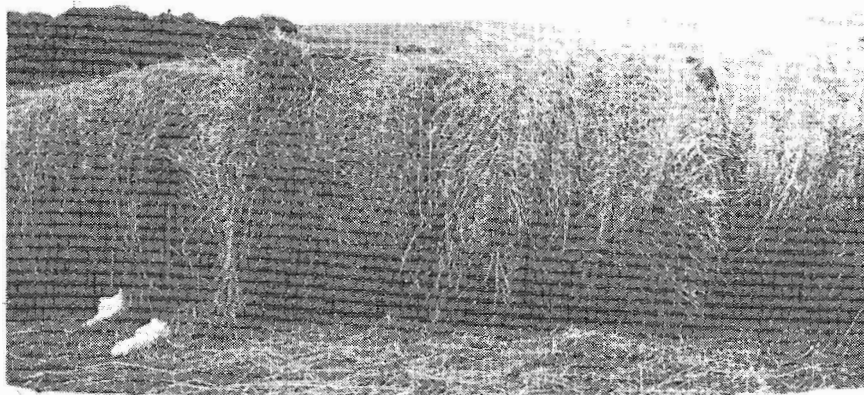


Figure 2. Large round bales end-to-end in storage.



Figure 3. Pyramid stack of large round bales in storage.

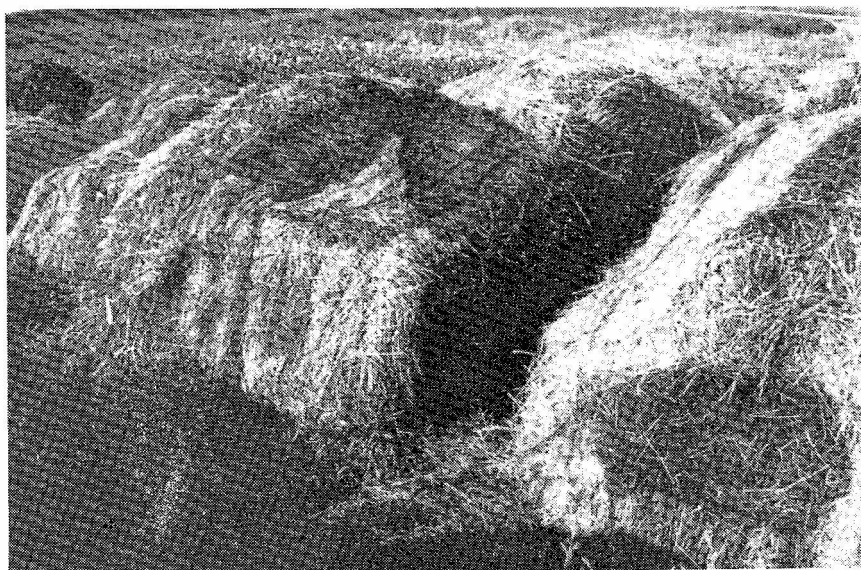


Figure 4. Deterioration of large round bale which was stored in a pyramid stack.

Table 1. Losses from Large Round Bales Stored Outside for One Year

Stacking system	Bale number	Crude protein, %		IVDMD, %		Moisture content, %		Dry matter loss %
		Start	Finish	Start	Finish	Start	Finish	
End-to-end	2	5.47	5.43	40.1	37.0	12.9	12.5	0.9
End-to-end	5	<u>5.13</u>	<u>5.86</u>	<u>38.1</u>	<u>41.0</u>	<u>12.7</u>	<u>12.9</u>	<u>0.7</u>
	Average	5.30	5.65	39.1	39.0	12.8	12.7	0.8
Individual	3	5.39	5.96	37.5	37.5	13.4	12.2	2.8
Individual	8	5.34	5.40	34.1	37.5	11.3	12.9	1.9
Individual	9	5.04	4.84	41.0	36.5	13.4	11.7	6.0
Individual	13	4.71	5.14	40.0	39.1	15.5	10.6	5.9
Individual	18	<u>5.75</u>	<u>4.62</u>	<u>36.0</u>	<u>39.1</u>	<u>15.2</u>	<u>11.7</u>	<u>3.4</u>
	Average	5.25	5.19	37.7	37.9	13.8	11.8	4.0
Pyramid	1	5.13	5.62	39.5	32.0	10.5	17.0	4.2
Pyramid	6	6.16	5.86	35.5	31.0	13.3	21.0	6.4
Pyramid	14	5.86	5.67	38.5	31.0	13.9	16.6	13.6
Pyramid	15	4.72	4.90	38.0	34.5	13.7	13.4	8.8
Pyramid	19	4.77	5.33	37.0	32.5	14.2	23.5	16.4
Pyramid	20	<u>5.34</u>	<u>5.10</u>	<u>39.5</u>	<u>32.0</u>	<u>14.4</u>	<u>19.5</u>	<u>12.3</u>
	Average	5.33	5.41	38.0	32.2	13.3	18.5	10.3