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STORAGE CHANGES IN ROUND BALES

The acceptance of large round bales as an economical and labor-saving way to harvest hay has continued to increase.

The physical and quality changes in large bales during storage can be substantial, depending upon the method of storage.

The data presented is from Southeast Louisiana Dairy and Pasture Experiment Station 1980-1981.

Attachment

Storage Changes in Round Bales — Keep Them Protected —

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Farmers usually need stored feeds each year during periods when low temperatures and low soil moisture limit plant growth. Hay is one of the major stored feeds, but haymaking has been expensive, labor demanding and commonly results in weathering and reduced quality of the forage crop. Recently, however, much of the expense and labor have been reduced through use of large hay packages, of which the big round bale system has been the most popular.

Physical and quality changes in large bales during storage can be substantial, depending upon the method of storage. Losses during storage can be a critical problem in Louisiana because often hay is not very high quality when it is packaged. High humidity and frequent rains often prevent harvested forage from reaching the desired 15 percent moisture content (wet basis) before it is baled.

A study to evaluate inexpensive, simple methods of storing large round bales of ryegrass hay was conducted at the Southeast Louisiana Dairy and Pasture Experiment Station near Franklinton in 1980-81.

Storage Methods Evaluated:

Ryegrass was cut on May 5, 1980 and was baled on May 10 with a chain-drive forming machine. The big round bales were left in the field until May 12 when they were weighed, measured, stored, and sampled with a power-driven core sampler. The samples were used for quality analyses. Core samples and bale dimensions were also taken periodically during the storage period.

Six methods of storage were used in the study. Four bales each were stored (1) on a gravel bed, (2) directly on the ground, (3) on elevated wooden racks with plastic covers and (4) without plastic covers, (5) on automobile tires, and (6) inside a barn. The gravel bed was about 8 inches deep. The wooden racks were built by placing four treated posts in the ground in an 18- by 36-inch rectangle and nailing 1- by 6-inch treated boards, 18 inches long, to two posts on each side to form a support 16 inches above the ground.

Two bales from each storage mode were weighed, measured and analyzed for quality after 7 months. One of these was sliced open to examine interior spoilage and then ground in a hammer mill for use in *in vivo* digestion trials with sheep. The remaining bale was used in feeding trials to determine animal refusal when fed in a round-bale feeding cage. The other two bales were continued in storage until May 12, 1981, completing 12 months of storage.

Results:

A total of 20 in. of rainfall was recorded during the first 7 months of storage and an additional 23 in. fell during the last 5 months. This was about 50% less than the previous two years for the same period.

The decrease in the volume of hay in each bale was defined as shrinkage and it was the highest for bales stored on ground, averaging over 50% in 12 months, Table 1. Bales on gravel reduced in volume by 37% whereas those on tires and racks without covers shrank by 32% and 30%, respectively. Protected bales on racks and those in barn had low shrinkage of 18% and 14%, respectively, Table 1.

Handling loss was the amount of hay left at the storage site after a bale was moved. Bales on ground had high handling loss and more wet spots near the bottom while those protected from the weather had almost none, Table 1. Bales on tires were wet at the bottom as rain water was trapped in the tires during storage. This wet portion slipped off the bale while picking it up to move from the storage site. Wet hay near the bottom could be seen in bales stored on ground and tires during the sectioning process. Bales stored off the ground had lower handling loss than those on ground and tires but not as low as the protected bales, Table 1.

Storage Losses:

Storage loss, a measure of dry matter lost from bales during storage, was the lowest for bales in the barn. Covering bales stored on racks outside reduced storage loss significantly below that of the uncovered bales on racks outside. Unprotected bales had losses over 30% in 12 months while those on ground had the highest of almost 40%, Table 1.

Animal refusal was over 22% for bales stored on the ground. Hay stored on gravel was slightly more acceptable to animals while protected hay was the most acceptable. The portion refused from bales stored on the ground and on gravel may represent hay damaged by interior deterioration during the storage. Hay stored off the ground on tires and racks had about 6% refusal, Table 1.

Total loss, defined as the sum of handling, dry matter and refusal losses, during 7 months of storage was over 65% for hay stored in bales on ground. Bales on gravel ranked second with 50% loss, followed by bales on tires, 43%, and bales on racks without covers, 38%. Total loss was much lower for bales stored off the ground and protected from rain than for bales stored on the ground, on tires, or on racks without covers. Bales stored in the barn showed the least total loss of 3.5% whereas those on racks but covered totaled 14%, Table 1.

Storage Changes in Round Bales

Table 1. Initial Bale Conditions, and Storage and Quality Parameter Changes

Item	Gravel	Ground	Rack	Rack w/ Cover	Tires	Barn
Initial wt., lbs.	879	927	824	950	856	892
Initial density, lb/ft³	6.85	6.84	5.74	6.25	6.09	7.02
Shrinkage, %, 12 months	36.9	51.0	29.8	18.3	32.1	14.2
Handling loss, %, 7 months	1.2	15.0	5.2	0.0	2.0	0.0
12 months	4.0	12.4	5.0	1.7	17.8	0.0
D.M. loss, %, 7 months	31.2	27.0	26.0	12.3	35.4	2.3
12 months	31.9	39.8	31.8	11.1	33.0	8.8
Animal refusal, %, 7 months	16.8	22.6	6.6	1.5	6.3	1.2
Total loss, %, 7 months	49.8	65.2	37.9	13.8	43.0	3.5
Moisture change, %, 12 months	111.3	107.7	104.9	92.6	123.2	85.2
CP change, %, 12 months	128.8	139.4	125.7	130.7	124.2	109.4
AP change, %, 12 months	99.5	99.8	88.0	118.2	95.1	104.3
IVDDM change, %, 12 months	92.6	94.7	95.6	103.7	92.3	102.5
DDM digestion, %, 12 months	47.4	44.8	48.9	51.9	48.7	53.9
Protein digestion, %, 12 months	30.5	34.2	40.2	47.2	40.8	48.4

Quality Parameter Changes:

The initial value for each parameter was established at 100% to avoid expressing negative percentages. The average initial moisture for all the bales was 18.3%. Moisture increased during the 12 months of storage for all bales not protected from rain. The largest increase being for bales on tires of about 24%, Table 1. Some of this increase could be from rain water trapped in tires and then seeping into the bale from the bottom. Protected bales lost moisture during storage.

The heat generated inside bales during storage binds the protein to the fiber, making it unavailable to the animal. The available protein (AP) was calculated by subtracting the fiber bound protein from the total CP. The average initial CP, AP, and NDF were 9.7%, 7.7%, and 68.1%, respectively.

The increase in CP was about 30% for all bales except those in barn which was 9%, Table 1. The NDF value increased by an average of about 5% in 12 months. The AP value decreased for all bales not protected from the weather. The decrease was the highest, 12%, for bales on racks with no covers, Table 1. Bales on racks with covers increased in AP by 18%. Bales on ground and gravel remained unchanged in AP, Table 1.

The IVDDM for protected bales increased slightly in 12 months while the other bales decreased in IVDDM by 4 to 8%, Table 1.

The digestion values of digestible dry matter (DDM) showed that protected bales were more easily digestible after the storage than the unprotected bales. The lowest digestion value was for bales stored on ground, 45%, whereas the bales in barn averaged 54%, Table 1. The protein digestion followed a similar trend. After 12 months of storage, the protected bales had a digestion of about 48% while the bales on gravel, ground, rack (no covers) and tires had 30%, 34%, 40% and 41% values, respectively, Table 1.

It can be concluded from this study that large round bales of ryegrass should be stored off the ground and protected from rain during outside storage to minimize the quantitative and qualitative losses.