STORAGE OF GUINEA GRASS ROUND BALES

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ABSTRACT

Changes in quality of round bales of guinea grass were evaluated in outside storage for 6 months under high rainfall conditions. Five storage methods were compared. Bales stored off the ground and protected from the rain remained in good quality. Uncovered bales stored on the ground or elevated exhibited high dry matter losses and substantial reduction in nutritional value.

INTRODUCTION

High quality feed at low cost is the main impediment to the development of the livestock industry in Hawaii. Hawaii’s cattle industry is dependent on grazing large areas of pasture supplemented with imported feed. However, feeding of baled hay is becoming an accepted alternative and harvesting of forages in round bales is becoming a common practice. Because of the cost of storage structures, most round bales are stored outside, unprotected from the elements. The hay is inevitably subjected to spoilage because of the weather. The size, shape, density and plant species composition of the bales affect storage losses. In addition, method of storage also affects the rate and amount of spoilage, especially when exposed to high rainfall.

Several studies have been conducted to evaluate storage losses in large round bales. Rider et al. (1979) evaluated storage losses in alfalfa, bermudagrass and sorghum sudan grass round bales using six storage methods during a 20 month study. They reported that bales stored under shelter (barn) and those stored outdoors wrapped with black polyethylene displayed lower dry matter and digestible dry matter losses. Lectenberg et al. (1980) evaluated compositional changes and losses in large round hay bales stored outdoors. Loss of dry matter was reduced when bales were stored on crushed rock in comparison to those stored directly on the soil. They reported that total prevention of weathering losses could be achieved by storing bales indoors. Verma and Nelson (1983) evaluated quality changes and storage losses in large round bales of ryegrass and alfalfa hay under different storage methods. Covered bales stored on racks and bales stored in the barn exhibited lower shrinkage and quality loss when compared with other treatments. Covered bales exhibited a slight decrease in % moisture content while uncovered bales placed on racks displayed a slight increase in % moisture content. Ryegrass bales stored uncovered and on the ground showed as high as 65 percent total quantitative loss after seven months. Alfalfa hay in comparison, had lower losses due to greater bale density. They recommended storing bales off the ground with rain protection to minimize losses.

Huhnke (1988) determined changes in forage quantity and quality in an 8 month storage study. In the study, storage losses were minimized when bales were elevated and covered. Bales stored on pallets and under cover resulted in less than 2 percent dry matter loss while uncovered bales placed directly on the ground had average loss of 13.1 percent. He concluded that protection from precipitation was the most important factor affecting storage losses. The storage losses in round bales for Hawaii is not well investigated. Therefore, the following study was conducted with guinea grass formed into round bales and stored outdoors. Various storage methods were compared.

MATERIALS AND METHODS

Guinea grass was cut on 16 May 1989 and baled at approximately 19 percent moisture content (w.b.) on 19 May at Pahala, Hawaii. A Heston round baler (model 5530) was used to form the bales. The bales were transported to the University of Hawaii at Hilo, College of Agriculture Panaewa Farm Laboratory, located in the Puna District of Hawaii for storage. Prior to storage, the bales were weighed, measured and sampled using a core sampler. Four bales were
randomly assigned to each of the following storage treatments:

a. on ground without cover.

b. on gravel bed without cover

c. on wooden pallets without cover.

d. on wooden pallets with over half of the bale circumference covered with 4 mil black polyethylene

e. on wooden pallets and stored indoors (barn)

For each treatment, four bales were placed in a single row with the ends touching. Rows were spaced approximately 1.5 m apart. Both the gravel bed and wooden pallets kept the bales approximately 15 cm off the ground.

The bales were stored for 6 months. At the end of the storage period, all bales were re-weighed, measured and cored. A visual inspection was made of the bales general condition. Measures of hay quality used in this study were crude protein, available protein, fiber components and in vitro digestible dry matter. Dry matter and crude protein (CP) were determined as described in A.O.A.C (1980). Available protein (AP) was determined by subtracting insoluble protein from crude protein values. Insoluble protein was determined as described by Goering et al. (1972) to estimate heat-damaged protein. Fiber components were measured as neutral detergent fiber (NDF) and acid detergent fiber (ADF) as described by Goering and Van Soest (1970). In vitro digestible dry matter (IVD) was determined by the Tilley and Terry (1983) method.

Rainfall at the site of storage measured about 205 cm during the study.

RESULTS AND DISCUSSIONS

Percentage changes in quality parameters of the bales after 6 months of storage are shown in Table 1. Guinea grass hay stored indoors (barn) or outdoors on pallets with plastic covering exhibited the lowest change in quality. Bales stored in the barn showed no change in in vitro digestible dry matter (IVD) while guinea grass hay from all other storage methods had decreased IVD values. No significant difference was found in percentage change of crude protein (CP) content for any storage methods. Average CP content at the start of the study was 6.4 percent for all storage systems. After six months of storage, increase in CP contents ranged from 11 to 21 percent (Table 1). The bales exhibited differences (P<.05) in the percentage change in available protein (AP) among treatments. Loss of AP is usually associated with heat generated in forages during storage, which binds the protein to the fiber, thus making it unavailable to the animal. Our results, however, suggest little or no heat generation within the bales. Percentage changes ranged from 8.5 percent increase for covered bales to an average of about 24 percent increase for noncovered bales. The increase in AP values was probably due to dry matter as a result of weathering. Acid detergent fiber (ADF) content increased for all storage treatments. Increase in ADF values ranged from 1.9 percent for bales stored in a barn to 8.3 percent for noncovered bales stored on gravel bed (Table 1). ADF is a measure of the forage fiber that may be digested by a ruminant. A lower ADF content suggests higher digestibility and higher hay quality. Hence covered bales retain a higher level of digestibility compared with noncovered bales after 6 months of storage.

Changes in moisture content, dry matter and bale volume are shown in Table 2. Moisture content increased for noncovered bales. Bales stored on the ground and on gravel exhibited the greatest increase in moisture content. Visual inspection of the bales revealed that the area of the bale with direct ground contact appeared to be wet and moldy. Uncovered bales stored on pallets displayed significant change in % moisture content while covered bales on pallets and bales stored in the barn displayed a percentage moisture loss. A significant decrease (P<.05) of % dry matter after 6 months of storage was observed for all noncovered bales. Covered bales did not show any % dry matter loss (Table 2). % dry matter loss was highest for bales stored on the ground. Storing the bales off the ground with pallets or gravel reduced dry matter loss. Covered bales also exhibited low volume (shrinkage) and shape changes. Bales stored on the ground exhibited over 27% shrinkage after 6 months of storage while bales stored on gravel or pallets and not covered exhibited about 18 % shrinkage (Table 2). Volume change (shrinkage) was mainly due to erosion of the bale surface by rain and loss of bale material.

Our results indicate that bales kept off the ground with at least the upper half covered have reduced dry matter loss and volume change in a high rainfall area such as Hilo, Hawaii.

CONCLUSIONS

Dry matter loss and changes in nutritional value of guinea grass hay were dependent on storage method. Guinea grass bales stored off the ground and protected from the rain resulted in minimum total quantitative and qualitative losses.
during outdoor storage. Storing the bales on wooden pallets with plastic covers over the top halves resulted in no dry matter loss with only about 1.4 percent shrinkage. Bales stored directly on the ground exhibited the highest dry matter loss and volume change, averaging about 24 and 28 percent, respectively. Noncovered bales displayed an increase in % moisture content while covered bales had a decrease in % moisture content.

LITERATURE CITED


<p>| TABLE 2 | EFFECT OF STORAGE METHOD ON GUINEA GRASS ROUND BALLES. |
|------------------------|-------------------------------|-----------------------------|-----------------------------|-----------------------------|
|                        | Barn                          | pallets                      | pallets                      | gravel                      | ground                      |
|                        |Ninety Percent (6%)            | 119%                        | 117%                        | 118%                        | 205%                        |
|                        | Initial Final % Change        | Initial Final % Change       | Initial Final % Change       | Initial Final % Change       | Initial Final % Change       |</p>
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