

STORAGE LOSSES IN ROUND HAY BALES

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Abstract

Storage of compact and soft-centred round bales in an exposed position without protection from the weather resulted in total dry matter losses, including inedible waste, of 16 to 27%. Negligible losses occurred in bales stored in a haybarn. Siting bales in the lee of a shelterbelt generally halved losses but was not as effective as covering bales with polythene caps. Elevating bales off the ground by the use of posts failed to substantially reduce storage losses.

INTRODUCTION

FARMERS in New Zealand conserve over 3 million tonnes of forage as hay, which represents a financial input of approximately \$130 million annually. An increasing amount of forage is being conserved in the form of round bales because of easier handling and their reputed ability to be stored outside without detriment to quality. Recent work in a 750 mm rainfall area in New Zealand, however, has shown storage DM losses in round bales between baling and feeding to vary from 20% for meadow hay to 29% for lucerne hay (Scales *et al.*, 1978), a substantial economic loss to the industry.

The objectives of this study were to:

- (1) Compare losses in round bales stored in exposed and haybarn sites
- (2) Examine the effects of siting bales on posts to remove contact with the ground, the use of polyethylene covers and the effect of shelter on storage losses
- (3) Examine the influence of baler type on storage losses in round bales.

EXPERIMENTAL

EXPERIMENT 1

A 20 ha area of border-irrigated Saranac and Wairau lucerne (*Medicago sativa* L.) was mown at the 15% flower stage of

growth with a four-disc mower on 27.1.78. The above-mower-height dry matter yield was approximately 1900 kg DM/ha. Border strips were restrictively randomized on the basis of lucerne yield and allocated to either soft-centred (fixed volume) or compact-centred (variable volume) round balers. All lucerne was baled 4 days later on 31.1.78 at a DM content of 84%.

The hay was sampled from the swath immediately prior to baling and 20 bales weighed before random allocation to either exposed, sheltered (15 m high macrocarpa hedge), or haybarn sites. At both exposed and sheltered sites, half the bales were sited on three railway ties to eliminate contact with the ground.

All bales were unrolled on a sealed drive and sampled between July and November. Strips, approximately 225 mm wide, were removed from the bale at 4 m intervals, chaffed and subsampled for DM, crude protein and *in vitro* digestibility determinations. Rotted material was also removed from the bale and subsequently fed to sheep in metabolism crates to determine the proportion of inedible waste in the bale. Rainfall during the 240-day mean storage period was 759 mm.

EXPERIMENT 2

Areas conserved for hay and mowing techniques were similar to those in Experiment 1. The lucerne was cut on 19.1.79 at the 10% flower stage of growth with a yield of approximately 2600 kg DM/ha and baled three days later at a dry matter content of 80%. Twenty round bales were randomly allocated to storage sites as described in Experiment 1. Exposed bales were either covered with laminated polyethylene caps, covered and raised on posts, or uncovered. Bales stored in sheltered and haybarn sites were uncovered and placed directly on the ground.

Bales were sampled during July following a 186-day storage period. Rainfall during this period was 470 mm, of which 80% was recorded during March and April.

RESULTS

EXPERIMENT 1

Total losses, including dry matter and inedible waste, were highest for bales stored in an exposed position and lowest for bales stored in a haybarn (Table 1). Trends between baler types were similar and an average of 27% of the DM in exposed bales was lost by September. This can be compared with zero losses

TABLE 1: EXPERIMENT 1

Storage losses in round hay bales from baling to feeding (Mean of compact- and soft-centred bales)

<i>Storage Site</i>	<i>Dry Matter Loss (%)</i>	<i>Inedible Waste (%)</i>	<i>Total Loss (%)</i>
Exposed — ground	15	12	27
Sheltered — ground	10	5	15
Haybarn — ground	0	0	0
Exposed — posts	14	9	23
Sheltered — posts	9	6	15

for bales stored in a haybarn. The provision of shelter halved losses. The use of posts was variable and of less benefit than the provision of shelter.

Waste recovered from exposed bales was distributed evenly throughout the circumference of the bale and was not markedly influenced by siting bales on posts.

Storage of bales in an exposed position resulted in a reduction of 5.5 organic matter digestibility units compared with 1.0 unit for bales stored in a haybarn. Crude protein, calcium and phosphorus percentages of hay stored in an exposed position showed little change. Dry matter losses of compact-centred bales stored in an exposed site were 29% compared with 25% in soft-centred bales.

EXPERIMENT 2

Covering bales sited in an exposed position with 1.8 m by 1.7 m polyethylene caps reduced total storage losses from 16% to 7% (Table 2). Little further advantage was obtained by placing covered bales on posts. Siting bales in the lee of a shelterbelt was not as effective as the use of covers and the reduction was less than in

TABLE 2: EXPERIMENT 2

Storage losses in round hay bales from baling to feeding (mean of compact- and soft-centred bales)

<i>Storage site</i>	<i>Dry Matter Loss (%)</i>	<i>Inedible Waste (%)</i>	<i>Total Loss (%)</i>
Exposed — ground	11	5	16
Shelter — ground	8	4	12
Haybarn — ground	0	0	0
Exposed — ground-covered	4	3	7
Exposed — posts-covered	5	1	6

Experiment 1. No losses occurred in round bales stored in a hay barn. Dry matter losses of compact-centred bales stored in an exposed site were 19% compared with 13% in soft-centred bales.

DISCUSSION

Storage losses occurring in round bales stored without protection from the weather varied from 16 to 27% and confirms earlier findings by Rider and McMurphy (1977) and Scales *et al.* (1978). Between one-third and one-half of this loss was attributed to the presence of rotted and inedible waste, the remainder representing dry matter disappearance due to bacterial and fungal activity. Hay in exposed bales contained up to 18% more water at feeding than bales stored in a hay barn which may explain higher levels of waste material.

Siting bales on posts on the free-draining Lismore soils failed to substantially reduce losses and the similarity of waste distribution throughout the bale of elevated and ground-sited bales suggests that rainfall rather than ground infiltration is the major source of wastage in the bottom segment of exposed bales.

The results indicate that both compact- and soft-centred bales should be protected from the weather where rainfall is in excess of 500 mm during normal storage periods, best protection being offered by haybarn storage.

REFERENCES

- Rider, A. R.; McMurphy, W. E., 1977. *Am. Soc. agric. Engrs Paper* No. 1515.
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