New Approaches to Improve Alfalfa Round Bale Storage

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RATIONALE & OBJECTIVES

- Wrapping bales at high moisture for baleage is common but wrapping dry bales has not been widely investigated.

Objectives:

To modify an in-line bale wrapper so that breathable film could be applied to bales.

To compare storage characteristics of dry bales wrapped with three types of film (breathable film, black- and white- stretch plastic) with either four or eight layers of stretch plastic.

To compare the storage characteristics of dry bales wrapped at different initial moisture contents.

STUDY DESCRIPTION

- Modifications to an in-line wrapper were made so that breathable film could successfully be applied to round bales (Figure 1). Studies were conducted with first and second cutting alfalfa bales. Seven treatments were considered: (1) unwrapped store indoors, (2) unwrapped stored outdoors, (3) wrapped in 3 layers of breathable film, (4 and 5) wrapped 4 or 8 layers of white plastic film, and (6 and 7) wrapped 4 or 8 layers of black plastic film. Four (1st cutting) or three (2nd cutting) replicate bales were used per treatment. Bale storage conservation was quantified by final moisture content at various locations in the bales, dry matter loss during storage, bale temperature, and changes in constituents.

RESULTS

- Modifications to the bale wrapper to apply breathable film were successful.
- Overall conservation of DM was very good across all treatments studied. Spoilage was typically limited to the surface and outer layer of the bales. Nutrient composition was not different between storage methods.
- Neither the plastic film color nor number of layers made a significant difference in storage conservation. Bales conserved with breathable film were observed to have less surface spoilage than those wrapped in plastic film.
- Condensation of moisture and spoilage on the bale's outer layers and base occurred with stretch plastic film when average initial bale moisture was greater than 19 %. Issues of condensation and surface spoilage were not apparent when bale moisture was 15% to 19%. These results suggest that even a few percentage points difference in the initial bale moisture can have an important impact of condensation on the interior surface of the wrap and subsequent spoilage on the bale surface.
- Spoilage was observed between adjacent bales that had different diameters which caused overstretching of the film and oxygen infiltration that promoted mold growth.
- Bales wrapped with black colored wrap exhibited elevated diurnal temperatures and showed browning and caramelization consistent with Maillard reactions on the surface.

Figure 1. Dry alfalfa bales wrapped in breathable film using the modified bale wrapper. Note spiral wrap of tape at the training edge seam to seal the film.

Figure 2. Moisture content distribution images for bales wrapped in black plastic film. Left – 1st cutting stored at 19% moisture. Right – 2nd cutting bales stored at 15% moisture. Scale located to right – moisture content %w.b.

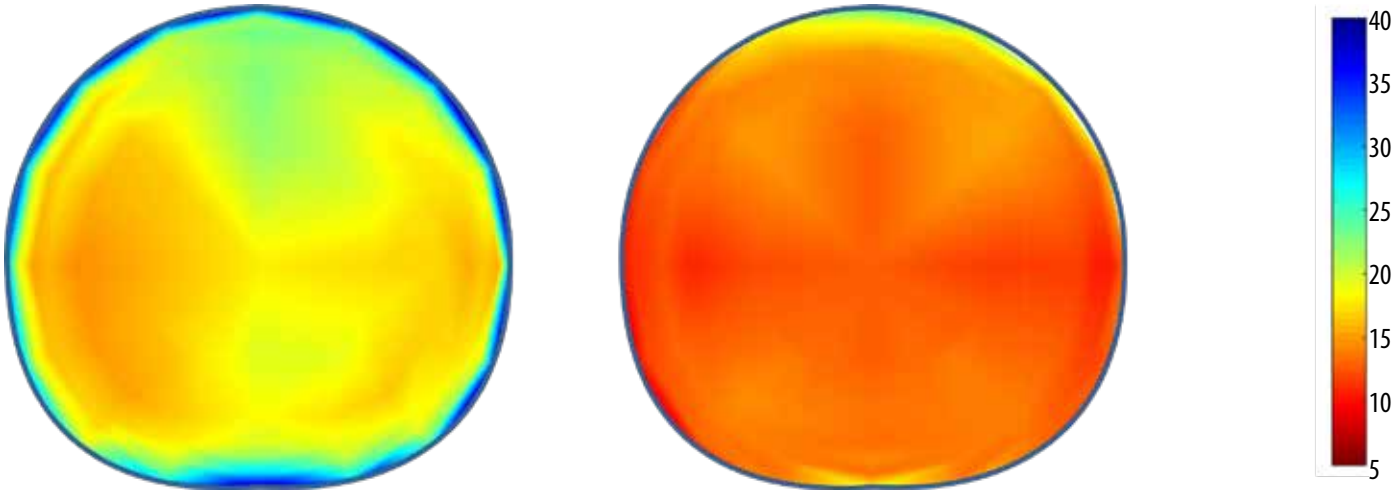
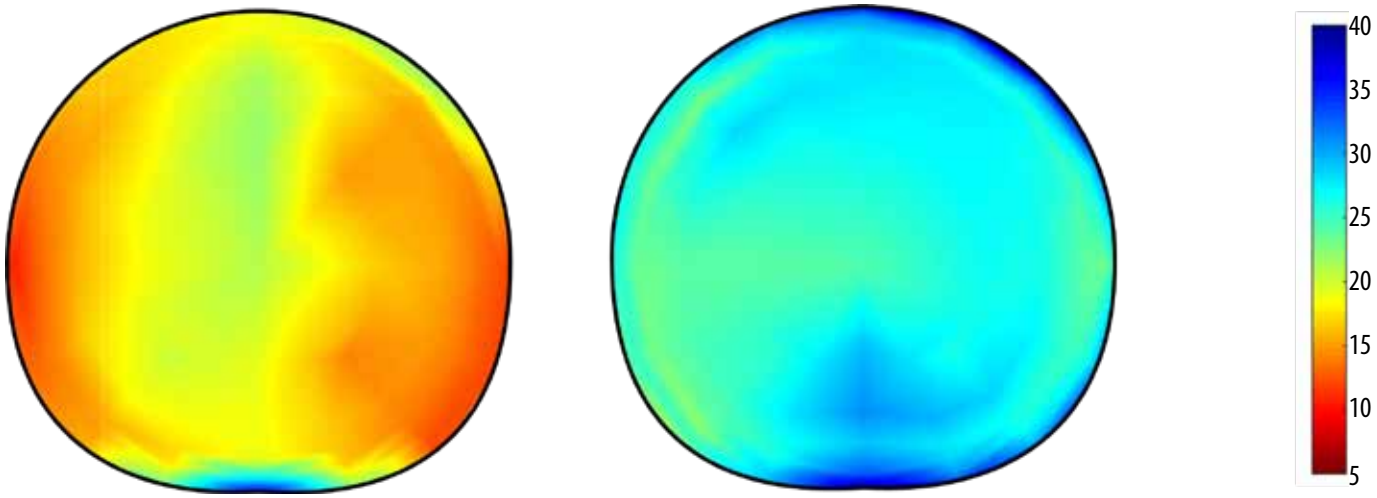


Figure 3. . Moisture content distribution images for 1st cutting bales. Left – Wrapped in breathable film stored at 19% moisture. Right – Wrapped in 8 layers of white plastic film stored at 20% moisture. Scale located to right – moisture content %w.b.



MANAGEMENT CONSIDERATIONS

- Condensation of moisture on the outer layers and base of the bales occurred with bales wrapped with stretch plastic film, especially when bales were greater than 19% (w.b.) moisture.
- Achieving bale moisture less than this 19% can be difficult in humid climates. If weather conditions make it unlikely that moistures less than 19% can be attained, producers may want to consider wrapping at greater moisture (35% to 45%) to promote fermentation as baleage.
- Uniform diameter, square shouldered bales will help ensure that the film will not be overstretched between adjacent bales. This will help reduce oxygen infiltration and mold growth.

Alfalfa
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