

2019 USAFRI Research Project Objectives

New Approaches to Improve Alfalfa Round Bale Storage University of Wisconsin-Madison - Shinnars, Digman

Project Award: \$41,512

Justification:

- Baleage is becoming a more common method of conserving alfalfa round bale value. Producers are adopting this practice because the shorter field drying time reduces weather risks and losses during storage are very low [1,2]. The growth in alfalfa baleage has resulted in greater farmer access to tube wrappers – either through direct or shared ownership, or through dealer rentals. Additionally, wrapping alfalfa bales in an in-line tube uses considerably less plastic film than individually wrapping [2], so it is a popular choice for economic reasons. However, alfalfa baleage at moistures of 45 to 55% does not always result in a higher quality forage. For instance, when baling occurs remotely from the end use, then wrapping is delayed by gathering and transport. Consequently, spoilage can begin before wrapping can occur. Furthermore, if a producer does not use the fermented bales fast enough at feedout, then additional spoilage can occur. If bales will be sold and shipped, then issues of spoilage and excess load weight challenge the economics of selling alfalfa baleage. Finally, some customers simply do not want to buy and feed alfalfa baleage but continue to desire dry alfalfa hay. So producers who make baleage are also interested in being able to conserve dry alfalfa hay by tube wrapping with plastic film allowing them to expand their market while fully utilizing their equipment investment.

The practice of conserving alfalfa hay as high-moisture baleage has been researched and is well understood. However, the practice of wrapping dry alfalfa bales to conserve quality has not been the subject of extensive research and producers have found that the practice has not always been successful. For example, when bales are put up a “little tough” (i.e. when moisture is greater than 20%) water condenses on the interface between the bale and film and spoilage occurs. Although the spoilage layer may not very deep, a 2 in. layer of spoilage can represent 10 to 16% of the bale volume depending on diameter. And any spoilage of the outer layer makes the bale look spoiled and perception is important when the hay is marketed. This quote from New Ag Talk Forum (Febr. 2018) nicely summarizes the issue:

My experience wrapping dry hay in the past is that if the hay is extremely dry it works great. The bales will come out exactly like you put them in. But in the humid Midwest we rarely get hay as dry as we want. If you wrap say 16-20% hay it gets a slimy. The moisture migrates to the outside of the bales and it can't escape because of the plastic...

Producers have tried a variety of remedies to this issue, including using different colored film and slitting the film to allow an egress for moisture, but no rigorous research has been conducted to quantify the impact of these approaches. The goal of this research is to develop new systems and guidelines to improve the success of wrapping dry alfalfa hay bales. Our research results will provide alfalfa producers with recommendations on best practices for this storage method.

One remedy to the issue of moisture condensation causing spoilage that warrants consideration is the use of a breathable film (BF). BF can now be applied at baling and is designed to shed precipitation but allow water vapor inside the bale to escape through microscopic pores. The film allows water vapor, but not liquid water, to pass through a matrix of high-density polyethylene fibers. BF applied to individual bales has been shown to reduce dry matter (DM) loss during storage and conserve the outer

layer of the bale, thereby reducing animal rejection [2, 3]. The use of BF on individual bales has been successfully commercialized, but not widely adopted for several reasons:

1. The rolls of BF cannot wrap as many bales as a typical roll of net wrap, so more frequent stops for reloading rolls are required, reducing productivity.
2. To be compatible with the film length, the bales must be made within a narrow range of diameters, which limits flexibility of bale size, which may be important when bales are sold or shipped.
3. Bales must be oriented with the film end on the bottom or water may run into the open seam.
4. Bales must be handled carefully when gathered so as not to damage the film.
5. Currently only one brand of baler is compatible with the available BF.
6. The cost per bale is about \$6 more than simply wrapping with net wrap.

Using BF to tube wrap dry alfalfa bales could overcome each of these issues discussed above. Since bales will be wrapped with BF after baling and gathering, issues 1 – 4 are resolved. Any brand of baler can be used to make the bales and they can be made any diameter desired. Finally, the cost of tube wrapping bales with stretch plastic film is about \$4 – \$5 per bale which is just slightly less than wrapping with BF.

Objectives:

- The objectives of this project are to 1) Modify a conventional in-line tube bale wrapper so that breathable film can be applied to dry alfalfa bales; 2) Compare and quantify the storage characteristics of dry bales wrapped in a variety of different ways; and 3) Suggest “best practices” based on the results of research efforts.