## Improving Round Bale Collection Productivity by Bale Accumulation

## Kevin Shinners, University of Wisconsin

ound bales are typically randomly deposited in the field and are collected after harvest. Because round bales shed water, they do not have to be moved immediately but should be gathered and removed before regrowth begins so wheel traffic does not reduce the next crop yield.

Round bales can be gathered and transported in a variety of ways from single-bale to machines that gather many bales at a time. The two most common methods include a single-person operation where a loader is used to pick and load individual bales onto a stationary trailer, and a multi-person operation where the vehicle pulling the trailer is moved strategically to reduce the travel distance of the loader. No matter the gathering method, the task of retrieving bales entails considerable field traffic and time. One strategy to reduce traffic damage and increase collection productivity is to accumulate bales on the baler and place the bales in strategically placed groups at the time of baling.

Collection productivity is influenced by many uncontrolled variables like field shape, area, spacing between windrows, yield, and skill of the loader operator. Current round bale accumulators can hold from one to three bales, so groups of two to four bales can be made when the bale in the chamber is ejected with the bales on the accumulator. Current machines accumulate the bales in a straight line behind the baler, so as the number of bales gathered increases, so does the machines length.

To quantify the benefits of bale accumulation, performance of a two-bale accumulator across a number of fields with varied shapes, slopes, and yields was quantified. Two gathering strategies were employed, one with a single-person where the transport trailer remained in a fixed position when loaded, and the other with multi-person where the trailer was moved during loading. The baling and grouping strategy involved trying to get groups of bales placed in lines across the field rather than randomly dropping groups of bales (Figure 1). With the single-person collection, bale accumulation and

Figure. 1. Location of randomly dropped and accumulated bales. Note differences in field traffic between the two collection methods.



grouping reduced collection time, travel distance, and fuel use by 31%, 47%, and 37%, respectively. With the multi-person collection, bale accumulation and grouping reduced collection time, travel distance, and fuel use by 16%, 36%, and 17%, respectively. Moving the trailer had less of an effect on time than travel distance because maneuvering and positioning made up a greater fraction of the total time than travel time. In this study, yields ranged from 0.8 to 3.1 dry tons/ac (alfalfa and switchgrass, respectively). When yields exceeded 3 dry ton/ac, accumulation had limited impact on travel distance because at these yields randomly dropped bales are located close together. Bale accumulation and strategic bale placement significantly improved bale collection productivity and reduced field traffic. The next step in this work is to do an economic analysis of bale accumulation to determine if the ownership and operating costs of the accumulator are offset by reduced bale collection costs.

This project was supported by an Agriculture and Food Research Initiative Competitive Grant (No. 2011-68005-30411) from the National Institute of Food and Agriculture. The grant is titled CenUSA - Sustainable Production and Distribution of Bioenergy for the Central USA.

## Forage Focus, May 2014