SDSU DEMOS SHOW VALUE IN STORING FORAGE INSIDE, UNDER TARPS

Sara Bauder, Tracey Erickson, South Dakota State University-Extension; Dr. Kevin Shinners, University of Wisconsin

A South Dakota State University (SDSU) Forage Field Day last summer dramatically showed farmers how bale stacking and storage can affect forage quality and moisture content. As a part of the field day, held Aug. 7 at the Southeast Research Farm near Beresford, farmers could compare the condition of bales stacked in various ways outside with bales stored within a building. A presentation on bale stacking and storage was made by Dr. Kevin Shinners, University of Wisconsin Agricultural Engineer. He, along with Sara Bauder and Tracey Erickson, SDSU Extension Field Specialists, also provided a hands-on bale-stacking demo.

Their presentations took forethought and preparation. On Feb. 1, 2019, a load of 44 net-wrapped hay round bales that weighed an average of 1,479 lbs was delivered to the research farm. Each bale was weighed and stacked outdoors on a slightly sloped, well-drained area.

Seven bale stacks were formed; the methods of how each stack was made are detailed in Figure 1 (identified as Piles A-G). Each stack was core-sampled at initial stacking on Feb. 1 and samples were sent to a lab for compositional analysis. Bales were left untouched for the remainder of the winter and most of the summer until stacks were core-sampled, moisture-probed, and weighed again on July 25, about two weeks prior to the field day.

The 2019 cropping season was unseasonably wet, with about 20" of rain falling at the Southeast Research Farm from Feb. 1 to July 31 (climate.sdstate.edu).

A Delmhorst moisture sensor was utilized to create the moisture distribution maps shown in this article. The 'control' bales stored indoors on a dirt floor picked up some moisture via wicking, but were otherwise dry and similar in weight to their weight going into storage (Table 1). However, bales stacked in other formations did not fare as well. For example, bales in Pile G were observed to have moisture damage and mold growth, especially to the bottom bales which took on excess moisture (Figure 1). Bales in the bottom of the 'pyramid stack' also were observed to have moisture damage (Pile F); in fact, two bales weighed more in August than they did in February due to moisture accumulation.

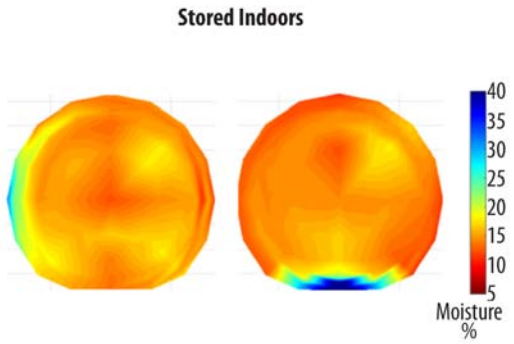
This demonstration reinforces that when storing round bales outdoors, stacking of any kind may result in poor shedding of precipitation and slow drying that will most likely lead to dry matter losses and reduction in nutrient value (Figure 1, Tables 1 and 2). Leaving adequate space between bales (simulated by Pile B) allowed water to shed off bales and resulted in less moisture accumulation as compared to bale stacking.

Table 1. 2019 Bale-Stacking Demonstration-Bale Weight. Beresford.

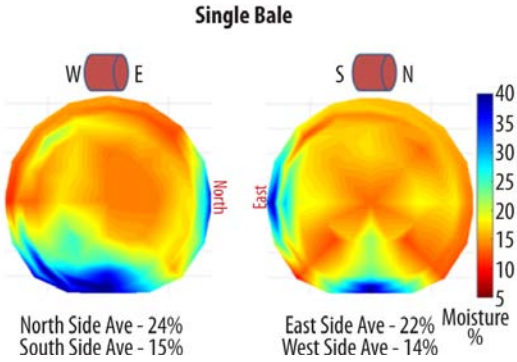
Pile[1]	Initial Weight (Avg.) 1-Feb	Final Weight (Avg.) 25-Jul	Weight Loss (Avg.)
	lbs.	lbs.	lbs.
A	1474	1368	106
B	1438	1332	106
C	1540	1378	162
D	1492	1364	128
E	1480	1315	165
F	1437	1356	82
G	1476	1327	148

See pile description in Figure 1.

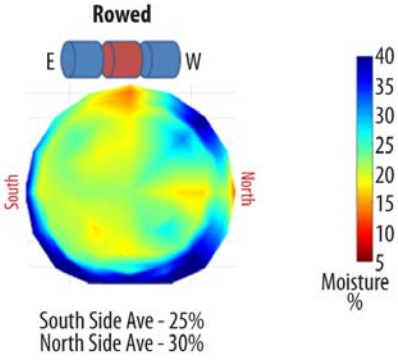
Figure 1. Maps show forage moisture content levels in round bales stored in various ways. Dr. Kevin Shinners, UW-Madison



Pile A. Two bales stored in a building with a dirt floor.



Pile B. Two bales set alone outdoors; one facing east/west, the other, north/south.

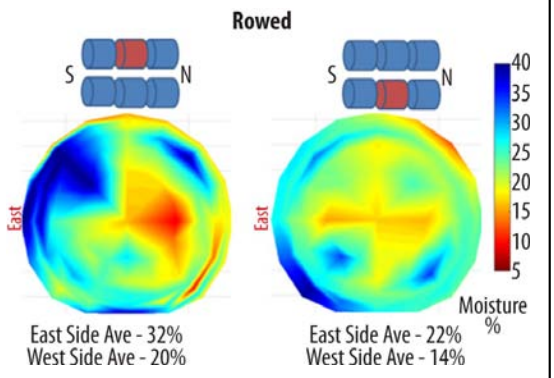


Pile C. Three bales rowed from east to west outdoors with faces nearly touching. Moisture samples taken from bale indicated in red.

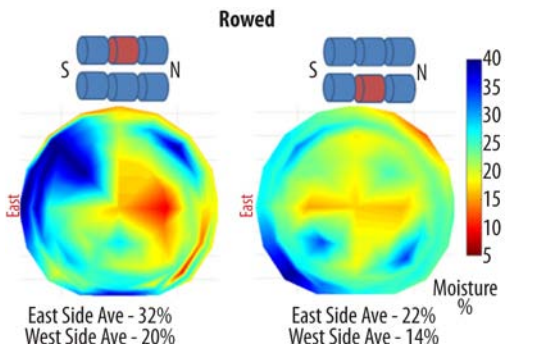
In addition, the demo showed extensive quality losses on bottom bales in Piles F and G, likely due to water shed from top bales. It is also clear that where bales touched in rows or piles, moisture accumulated.

The best bale conservation always comes from protecting bales from the elements – storing under tarps or inside buildings. Wrapping bales in plastic or breathable film (such as B-Wrap®) will also help conserve value; however, bales stored outdoors and uncovered can still be well-conserved if farmers use the following simple practices: Don't place bales where they will be shaded, and put bales in rows that run north to south with about 3' between rows. These practices help sunlight dry bales after precipitation. There are pros and cons to how the rows are made. Butting bales tightly together helps keep rain and snow away from the bale face and takes less storage space. On the other hand, rowing the bales with a 12-18" gap allows a bale face to dry if it gets wet. Bales should be on a slight slope to help water drain away. Placing bales on a well-drained surface like a rock pad is an ideal way to drain water away. The guiding principles here are to help water drain away from the bales and use the sun to help the bales dry after they have been exposed to rain or snow. For a full report on this bale demonstration project, see the 2019 Southeast Research Farm annual report (to be printed in January 2020).

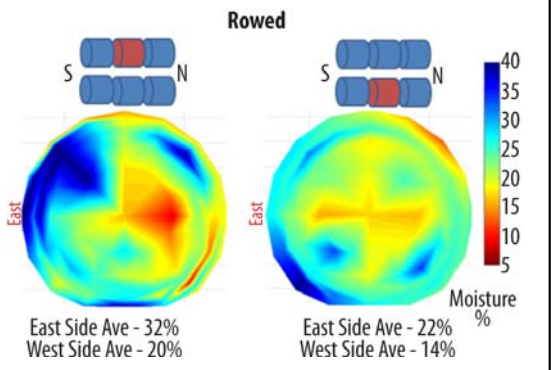
Figure 1 (Cont).



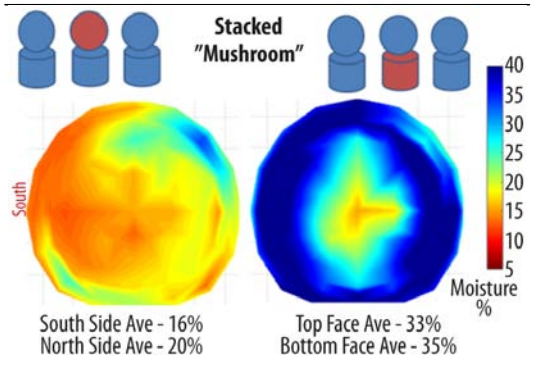
Pile D. Six bales rowed from north to south outdoors. Approximately 3' between rows and faces nearly touching. Bales probed indicated in red.



Pile E. Four bales placed in a 'pod' facing north and south outdoors. All bales butted together tight. Bales probed indicated in red.



Pile F. Eleven bales placed in a pyramid (6 on bottom, 4 on second layer, 1 on top) facing north/south outdoors. Bales butt together tight.



Pile G. Six bales placed in 'mushroom' stacks with top bales facing east/west outdoors. ~3' left between stacks. Bales probed shown in red.

Table 2. 2019 Bale-Stacking Demonstration Hay Quality Results. Beresford.

Pile[1]	DM[2]		CP[3]		RFV[4]		RFQ[5]	
	1-Feb	25-Jul	1-Feb	25-Jul	1-Feb	25-Jul	1-Feb	25-Jul
	%	%	%	%				
A	81.72	84.04	17.31	17.8	126	119	130	116
B	79.77	84.15	17.21	17.23	118	105	119	101
C	78.88	82.03	17.48	18.06	113	97	121	96
D	79.99	82.95	17.89	18.65	122	111	136	110
E	78.03	82.02	16.88	18.98	100	105	103	108
F	84.99	82.33	16.51	17.79	94	97	116	102
G	*81.33*	*83.36*	*17.57*	*17.96*	*104*	*107*	*105*	*99*

[1] See pile description in Figure 1, [2] Dry matter, [3] Crude Protein, [4] Relative Feed Value, [5] Relative Forage Quality

Currently, other forage projects are underway at SDSU, including but not limited to, an alfalfa variety trial, cool-season forage trials, an alfalfa winterkill evaluation study, a cover crop nutrient cycling investigation on South Dakota croplands, and more.