

The Economics of Hay Quality

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Introduction

Hay quality is often discussed when one considers the viability of cash hay operations. A great deal is known about how production impacts quality and how quality impacts animal performance. This knowledge certainly has economic implications, but the economics of hay quality has primarily been evaluated from the animal performance perspective. Analyzing the economics of hay quality from the cash hay producer's prospective becomes more difficult due to data limitations.

There are approximately 2.5 million acres of hay produced in Kentucky annually. The vast majority of this hay is grass type hay that is produced and fed on beef cattle operations. Higher quality hay production represents a much smaller portion of Kentucky's hay industry, yet yields much greater value on a per acre basis. While a much larger share of this "upper end" hay production is sold off the farm, most is sold through private treaty, which means sale data is not available. Auction markets are becoming more commonly used in hay marketing and provide greater opportunity to analyze factors that impact hay value.

Sale Process and Data

An annual January hay auction has been held in Richmond, KY for several years. This sale provided a unique opportunity to evaluate multiple factors that impact the value of hay, including hay quality. By statistically analyzing these sales, we were able to estimate how much impact quality factors truly had on hay values. Other factors such as bale weight, lot size, round vs. square, and forage species were also evaluated. Before discussing the findings of this analysis, it is likely worthwhile to further explain the data and sale process.

Hay arrives at the sale location over the course of the week prior to the auction. Hay test data and average weight per bale is posted with each lot of hay. TDN and Crude Protein are circled for each lot and buyers are provided with a publication on interpretation of the analysis as well as nutrient requirements for cattle and horses. Commission on the sale is 10% of total value, up to \$400 maximum per consigner. There is no cost to sellers if hay does not sell.

Hay auction data was available for the years 2012, 2013, 2015, 2016, and 2017. The Richmond hay market area is largely cow-calf with some pleasure horse influence. It was estimated that roughly 70% of the buyers were beef producers and 30% were horse farms. There were typically 30-50 lots of hay sold each year with a lot being defined as multiple rolls or bales that were sold together. A total of 215 lots of hay were used in the analysis over the five years analyzed. Understanding the qualities of this particular hay auction are useful to understanding the results discussed in the following section.

Findings

Results from the analysis provided useful information on factors that buyers value at this hay auction. Table 1 provides a basic summary of the data analyzed from the 5 sales. As can be seen in table 1, 59% of the lots sold were sold as large round bales and 41% were sold as small square

bales. Hay was sorted in quality groups based on TDN with high quality being hay that tested with TDN values greater than 50%, medium quality being hay with TDN 40%-50%, and low quality being hay with less than 40% TDN values. As expected, higher TDN groupings sold at higher prices and this was especially true for square bales.

Table 1. Descriptive Statistics – Hay Form and Quality		
	# of Lots Sold	Average Price per Ton
Round bales	127	
High Quality	21	\$98.30
Medium Quality	72	\$69.25
Low Quality	34	\$52.77
Small Square bales	88	
High Quality	44	\$249.32
Medium Quality	39	\$193.90
Low Quality	5	\$131.73

While comparison of averages is useful, further analysis allowed for estimation of the impact of individual lot characteristics on sale price. Note that results are only shown for significant variables of interest. Statistically, the price impact of individual attributes are isolated. For example, the impact of Crude Protein should be interpreted under the assumption that all other attributes were the same.

Results for large round bales are shown in table 2. As expected, TDN was an important factor in explaining hay price. Lots of hay falling in the high quality category (TDN>50%) were associated with nearly a \$23 per ton higher price than the low quality category (TDN<40%). Lots of hay in the medium quality category were associated with nearly \$15 higher prices per ton than the low quality category. Bale weight was included and found to be significant, however the magnitude of this impact on large round bales was extremely small. A 1% increase in Crude Protein was associated with a \$3.35 higher price per ton. Finally, some hay lots were noted as having sticks, being stemmy, or otherwise being of poor quality. Hay falling into this category sold for more than \$28 less per ton than hay that did not fall into this category.

Table 2. Statistical Impact of Hay Characteristics on Sale Price Large Round Bales – selected results	
Hay Characteristic	Estimated Impact on Price per Ton
High TDN	\$22.68**
Medium TDN	\$14.86**
Crude Protein (%)	\$3.35***
Bale weight (lbs)	-\$0.02**
Poor quality notes	-\$28.15
*, **, and *** denote statistical significance at the 90%, 95%, and 99% Confidence Level	

Table 3 shows results for small square bale prices. As expected, quality was found to have greater impact on small square bales than on large round bales. Square bale lots falling in the high TDN category (TDN>50%) sold at more than a \$79 price premium to low TDN square bales (TDN<40%). Square bale lots falling into the medium quality level sold at more than a \$58 premium to low TDN. Similar to what was seen with large round bales, crude protein had a significant impact on price with each 1% increase in crude protein associated with a \$3.64 per ton increase in sale price. Finally, we wanted to examine how price was impacted as square bales get larger. This is something that is discussed by many cash hay producers, but is very difficult to quantify. For this auction, every one pound increase in square bale weight was associated with a \$3.16 lower price per ton. These findings will be discussed further in the following section.

Table 3. Statistical Impact of Hay Characteristics on Sale Price Small Square Bales – selected results	
Hay Characteristic	Estimated Impact on Price per Ton
High TDN	\$79.12***
Medium TDN	\$57.58**
Crude Protein (%)	\$3.64*
Bale weight (lbs)	-\$3.16**
*, **, and *** denote statistical significance at the 90%, 95%, and 99% Confidence Level	

Discussion and Implications

As with any study such as this, results should be interpreted within the framework of the sale location. For this reason, one should be careful not to assume that these results are representative of hay markets across Kentucky. For example, I think some differences would likely have been seen in areas where dairy producers are active bidders in hay auctions. Still, I think this work provides some solid and quantifiable results that have implications for hay producers.

Few will be surprised by the finding quality has more impact on the price of small squares than large round bales, but the magnitude of those difference is striking. There was considerable evidence that buyers will pay more for higher quality hay. One must also remember that there is significant premium for small square bales over large round bales in the marketplace. A simple comparison of average prices from table 1 makes this point. However, in combined statistical models not shown in this article, the price difference for similar hay sold as square bales versus large round bales was even larger. Put simply, square baling is probably to single easiest way to add value to hay and this added value tends to increase as quality increases. Certainly, there is significant additional cost in machinery and labor to produce and handle square bales, but there is also potential for significant price premium.

We also wanted to examine the impact of bale weight on sale price. Hay producers have continually described a strong preference for smaller square bales, primarily for their equine clients. This work attempts to quantify this effect and finds that each additional lb is associated with a price decrease of \$3.16 per ton. For example, consider a 50 lb square bale that is valued at \$5 per bale, which works out to be \$200 per ton. If this same square bale weighed 40 lbs, these results would suggest that it would sell for an additional \$31.60 per ton or \$231.60. Think about this on a 5-7 ton per acre yield and one can see how this can add value to hay.

This work is on-going and further analysis will be conducted in the coming months. However, preliminary results clearly suggest the importance of hay form, quality, and weight as significant factors in determining hay value. First, the value differences between large roll bales and small square bales exceeded our initial expectations. Second, even in a sale location where the hay market is primarily driven by cattle producers and pleasure horse owners, TDN and Crude Protein were significant factors in determining that value of hay. Finally, evidence was found to quantitatively support the notion that producing smaller square bales can significantly impact revenue per acre.