FUEL USE AUDITS IN COTTON GINS

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Abstract

Surveys have shown that fuels used for drying and moisture restoration systems at cotton gins typically account for just under 10% of variable costs; although fuel costs vary widely and are the least predictable expense for gins. Furthermore, drying system performance is likely affected by air flow rates in drying system, which significantly affect gin electricity use. Previous studies have found that the fuel use efficiency of gin drying systems is less than 25%, although this data is from a limited range of conditions and dryer designs. A research project was initiated to estimate the fuel used by each burner in commercial gins, calculate the fuel use efficiency of each drying system, and determine the impact of operational parameters, seed cotton moisture, and dryer designs on efficiency. Preliminary studies were conducted at four gins during the 2015 ginning season, while fuel use was monitored at 25 gins across the cotton belt during the 2016 season. These gins had ginning rates from 20 to 60 bales per hour, used propane or natural gas as fuel, had from one to three stages of drying, and often used humid air moisture restoration systems. A number of different dryer designs were used at the monitored gins- conventional tower, high-volume tower, hot box, vertical flow, collider, fountain, jet, hi-slip, and using heated air for conveying without a dryer. For each heated air stream in these gins, air velocity and temperature was measured to estimate the fuel required to heat the air stream. Seed cotton samples for moisture content determination were collected before and after each drying system, as long as a safe location for sample collection was found. Thirty seed cotton samples were collected at each location at a rate of one per bale. Drying system fuel use efficiency could then be calculated based on the energy used to evaporate moisture from the seed cotton and the energy required to heat the air. In 2015, quality data was obtained from one gin as data collection and sampling methods were refined. Average fuel use efficiencies of the first and second stage drying systems were 15% and 6%, respectively. In 2016, much of the seed cotton was dry with moisture contents of 7% or lower, due to unusually dry weather across much of the cotton belt. However, some seed cotton with moisture content near 10% was sampled, particularly in TX and late in the season at some SE gins after heavy rains. Preliminary observations that have implications for energy use are that air reused from the first stage of drying in the second stage still provided substantial drying. With dry conditions and burners turned off, ambient air provided a small amount of additional drying. A significant number of seed cotton samples taken immediately before the gin stand had moisture levels less than 6%. This seed cotton moisture level corresponds to a fiber moisture level less than 5%. Many previous studies have shown negative impacts on fiber quality when cotton is processed at this fiber moisture level.