This technology is currently available for licensing.

Implementation and Evaluation of Using a Hydraulic Pressure Transducer to Determine Bale Weight of Round Hay Bales

H. Guy Ramsey, IV1, Perry J. Loftis1, Kendall R. Kirk2, G. Scott Sell2, Young J. Han2
1 Agricultural Mechanization & Business, AS, Clemson University, Clemson, SC
2 Edisto Research & Education Center, PSA, Clemson University, Blackville, SC
3 Simpson Research & Education Center, PSA, Clemson University, Pendleton, SC

2016 ASABE Annual International Meeting
Sponsored by ASABE
Orlando, FL.
July 17-20, 2016

BACKGROUND

Related Technology

- Load Cell Weighing Systems
- Expensive Technology
- Construction Equipment
- Peanut Combine

Objectives

- Install a pressure transducer on the hydraulic bale kicker ramp of a round hay baler
- Develop an algorithm structure
- Quantify accuracy
- Evaluate the effects of bale wrap and bale size
- Develop a commercial platform

Design and data acquisition

- Pressure transducer on extension kicker circuit
- Correlated sensor response to hydraulic pressure
- Correlate hydraulic pressure to bale weight

METHODS AND MATERIALS
**Design and data acquisition**

- Phidgets USB interface kit
- Data rate = 50 Hz
- Custom VB.net software
  - Logged sensor response when bale chamber opened

**How the Clemson bale weighing system works**

- Pressure transducer on bale kicker
- Records hydraulic pressure as bale is discharged
- Correlates peak(s) in hydraulic pressure to bale weight
RESULTS

Raw Kicker Data - Explained

- Peak related to first contact with bale (makes bale "jump")
- Peak related to second contact with bale (bale landing), this is the peak that is the best predictor of weight.
- Peak related to mechanical friction (unrelated to bale weight)

How the Clemson bale weighing system works

Net vs Twine (John Deere 458) – Raw Data

- a – net wrap
- b – twine wrap

Net vs Twine (John Deere 459) – Raw Data

- a – net wrap
- b – twine wrap

Comparison of Peaks – Raw Data
**Raw Data**

![Graphs showing data points and error percentages.]

**John Deere 458 – Data**

- First peak - not associated with mechanical friction.
- A – net
- B – twine
- C – mixed

**John Deere 459 – Data**

- 5.31% error
- 5.79% error
- 7.16% error
- A – net
- B – twine
- C – mixed

**IMPLEMENTATION ONTO A COMMERCIAL PLATFORM**

**Commercial Display**

![Display showing hay data and controls.]

**CONCLUSION**
### Conclusion

- Hydraulic pressure can be correlated to weight
- Bale size influences accuracy
- Type of wrap influences accuracy
- Errors of less than 8% possible
- Cost effective method of determining bale weight
- Further research is necessary to determine best calibration method

### Questions?