Introduction

- Harvesting corn (Zea mays) at 25% moisture results in drying costs of about CANS 19 /tons—translating to 250.8 million for the 13.2 million tons of corn produced in Canada in 2016 (MAFRD 2017; Statistics Canada 2017).
- Farmers can benefit from the development of corn genotypes that dehydrate (drydown) faster at physiological maturity.
- Traditionally a destructive, oven based or gravimetric drying method was used to measure the moisture content of a corn ear or its components. This method is not efficient for a breeding program aiming to select for a higher rate of drydown in corn (Kang, Zuber, and Horrocks 1978; Reid et al. 2010).
- Reid et al. (2010) developed two calibration curves to estimate the corn ear or total corn ear moisture (TEM%) and kernel only moisture (KM%) by regressing gravimetric moisture measurements with the total corn ear reading (TEMR) from an Electrophysics MT808 meter, (Electrophysics, ON, Canada).

Objectives

- To validate the calibration curves reported by Reid et al. (2010) using an independent dataset created in this study.
- To assess the measurement differences between both methods (meter readings vs. gravimetric estimation)
- To identify the critical moisture concentration where the meter is capable of giving the most accurate measurements.
- To develop a global calibration curve by pooling both the datasets.

Material & Methods

- Samples for the calibration experiment were collected from a field study with a randomized complete block design and three replications.
- Plot size was 3.04 m x 8 m.
- Four corn hybrid treatments were seeded on two planting dates (May 20, and June 01) for a total of eight treatments.
- The field study was repeated in 2015 and 2016 and was located at the University of Manitoba Research Farm, near Carman, Manitoba.
- In each treatment, five corn ears were randomly selected on 26, 47, and 66 days after silking and components of corn ear (bank, kernel and rachis/cob) were removed and processed separately for moisture measurements using both the Electrophysics MT808 meter (Figure 1A&B) and gravimetric method Figure 1B).

Statistical analysis

- Linear regression with NOINT: Figure 2, 4, 10 & 11
- Slope comparison between the current study vs Reid et al. (2010): Figure 5 & 6 as described by UCLA: Statistical Consulting Group (2017).
- Altman and Bland (1983) plot analysis to assess agreement between both the methods: Figure 6 & 7
- Histogram: Figure 8 & 9 to check the distribution of measurement deviations of moisture content between the Electrophysics MT808 meter and gravimetric method.
- All statistical analysis were performed in SAS 9.4 (SAS Institute, Cary NC).

Results

- The Electrophysics MT808 moisture meter readings and gravimetric measurement of total ear and kernel moisture were highly correlated (r² 0.89, 0.87 respectively in Figures 2 & 4). Therefore, this study confirms the findings of Reid et. al (2010) and that the Electrophysics MT808 moisture meter can be used as a rapid non-destructive tool to measure moisture content in corn.
- The Electrophysics MT808 meter most accurately measure the kernel moisture content of corn at 40-50%, when corn is typically in the dent stage. The meter underestimates the moisture content of both corn ears and kernels at gravimetric moisture contents higher than 50% (Figure 6 & 7). It overestimated the gravimetric moisture contents lower than 40%.
- The accuracy of the Electrophysics MT808 moisture meter is highest for kernel moisture content (mean bias -3.2 %, Figure 7) and lower for total corn ear moisture (mean bias -7.67 %, Figure 6). Similarly, 13% of kernel moisture meter measurements were identical to the gravimetric method, compared to 6 % for corn ear measurements (Figure 8 & 9). However, 54% of kernels meter moisture measurements were within ± 4 % of the gravimetric method (Figure 9).
- Pooling of original data from the current study and Reid et al. (2010) into a global calibration curve for the Electrophysics MT808 Total Ear Moisture Reading (TEMR) resulted in a revised equation for total ear moisture (TEM) = 1.28 x TEMR but the kernel moisture (KM) equation remains unchanged: KM = 1.09 x TEMR

References


Acknowledgements & Contact

Please, contact if you have questions or comments: Nasir.Javed@umanitoba.ca