Abstract #: W113

Relationship of Corn Silage Dry Matter Content to Density in Bunker Silos

K. Griswold[1], P. Craig[2], S. Dinh[1]

Penn State Cooperative Extension, [1]Lancaster and [2]Dauphin, PA

ABSTRACT

Dry matter (DM) content and density of corn silage (CS) was investigated in 103 bunker silos and piles over a 5-year period. For each silo/pile, 12 samples were collected using a 5.08 cm diameter stainless-steel coring tube driven by a gas-powered drill. Core depth was recorded to the nearest 0.64 cm, and wet weight was determined on a digital scale. Sample DM was determined with a Koster Crop Tester. Density was calculated by dividing core dry weight by core volume. Cores were collected at three vertical levels, bottom ≈ 1 m from silo floor, top ≈ 1 m from top edge, and middle ≈ equidistant between bottom and top. At each level, cores were collected horizontally at four locations, I and IV within 2.4 m of the outside edges, and II and III equidistant between I and IV. Data were analyzed using PROC REG and RSREG within SAS. When individual core density and DM content were regressed, there was a significant quadratic relationship ($P < 0.0001$, $R^2 = 0.13$). However, when level and location were included in the model as covariates, the strength of the relationship increased ($R^2 = 0.43$). Location was not significant in the model. These results suggest that DM content of corn silage is weakly related to density within bunker silos/piles and that level at which density is measured has a greater impact on density than DM content. Regression of the silo/pile average density and DM content showed a significant quadratic relationship ($P < 0.0001$, $R^2 = 0.28$), which suggested that DM content of corn silage may have greater impact on overall density of corn silage in silo/pile than density at specific positions within a silo/pile.

INTRODUCTION

- Research on the impact of dry matter content of silage on DM density has shown mixed results (Muck & Holmes, 2000).
- The overall suggestion was that DM density is positively correlated with DM content of silage within the recommended DM content for bunker silos (Muck & Holmes, 2000).
- However, most of the studies with positive responses were with hay crop silages. Studies with corn silage bunker silos found little effect of DM content on DM density (Savoie et al, 2004).
- The objective of this study was to determine if a positive relationship existed between corn silage DM content and DM density in bunker silos.

MATERIALS AND METHODS

- Over a five year period (2004 – 2008), 103 bunker silos/piles were sampled on 59 different dairy farms in south central and southeastern Pennsylvania.
- In each bunker silo, density samples were collected using a 60 cm long stainless steel corer tube with an I.D. of 5.08 cm. The coring tube was driven using a gas-powered drill.
- Samples were obtained from a bunker silo when the feeding face was in the middle 1/3 of the silo where densities were assumed to be the most uniform.
- Cores were collected from 12 positions across the feeding face of the silage. Cores were collected at three vertical levels, bottom ≈ 1 m from silo floor, top ≈ 1 m from top edge, and middle ≈ equidistant between bottom and top. At each level, cores were collected horizontally at four locations, I and IV within 2.4 m of the outside edges, and II and III equidistant between I and IV.
- Depth of each core was determined to the closest 0.64 cm in order to calculate core volume. Wet weight of each core was determined on a digital scale with an accuracy to 0.1 g. Dry matter content of core subsamples was determined using a Koster Crop Tester, and dry weight of a core was divided by core volume to determine DM density. Results were converted to a kg DM/m^3 basis.
- Data were analyzed using the Proc Mixed and RSReg procedures within PC SAS v9.1 (SAS Inst. Inc., Cary, NC).

RESULTS

Figure 1. Mean (+SE) of dry matter density and dry matter content of corn silage in bunker silos by year.

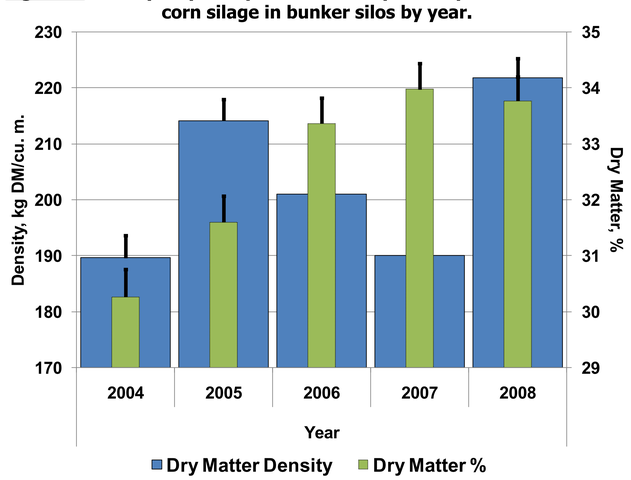
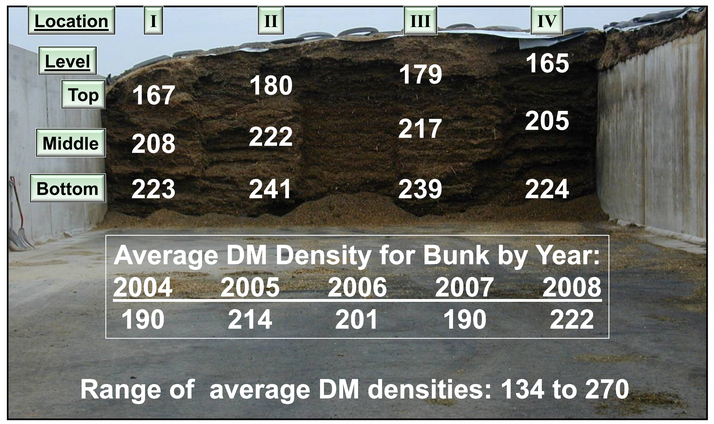


Figure 2. Average DM density (kg DM/m^3) of corn silage by position within a bunk for dairy farms in Southeastern Pennsylvania from 2004 - 2008



CONCLUSIONS

- Average DM content by year does not correlate with average DM density by year across bunker silos (Figure 1).
- Density was significantly affected by level ($P<0.0001$, SE=0.43) and location ($P<0.0001$, SE=0.44) (Figure 2). Density decreased from bottom to top of the silo, and locations I & IV were less dense than locations II & III. There were no significant interactions of level and location on density.
- Only 25% of all silos/piles sampled achieved the recommended goal of ≥224 kg DM/m^3 (Figure 3).
- A significant quadratic relationship ($P<0.0001$, $R^2 = 0.13$) between DM content and DM density was observed (Figure 4). Using level and location as covariates increased the strength of the relationship ($R^2 = 0.43$), but location was not significant in the model. These results suggest that DM content of corn silage is weakly related to density within bunker silos/piles and that level at which density is measured has a greater impact on density than DM content.
- Regression of the silo/pile average density and DM content (Figure 5) showed a significant quadratic relationship ($P < 0.0001$, $R^2 = 0.28$), which suggested that DM content of corn silage may have greater impact on overall density of corn silage in silo/pile than density at specific positions within a silo/pile.

Figure 3. Distribution of average DM density among corn silage bunker silos in southeastern Pennsylvania from 2004 – 2008.

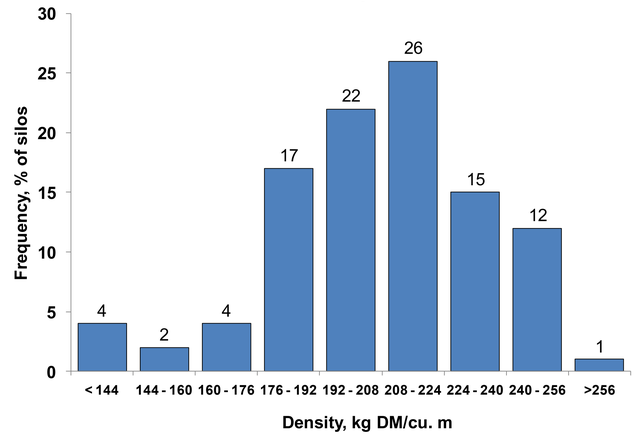


Figure 3. Regression of individual core DM density versus individual core DM content of corn silage in bunker silos in southeastern Pennsylvania from 2004 – 2008.

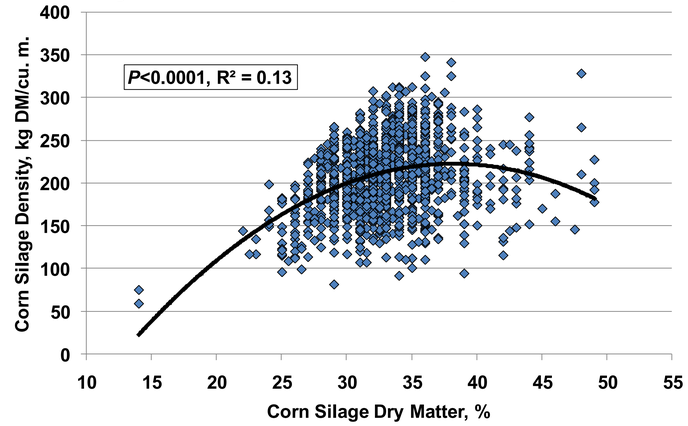
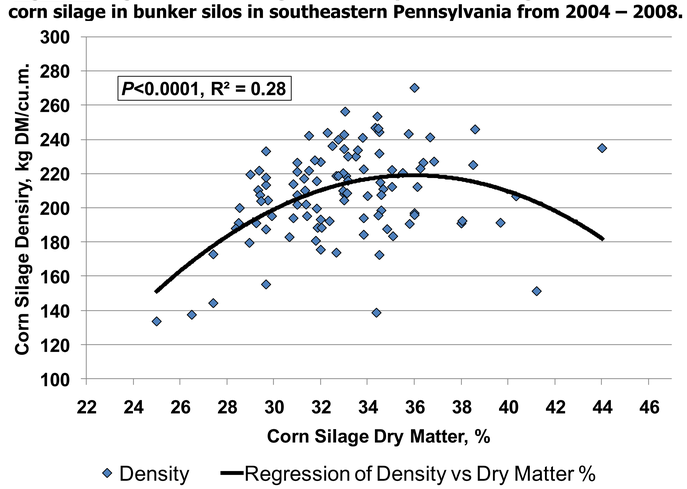


Figure 5. Regression of average DM density versus average DM content of corn silage in bunker silos in southeastern Pennsylvania from 2004 – 2008.



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