Fecal sample starch content deteriorates over time after sampling

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2014 ADSA-ASAS JAM
Poster M326

Introduction:

- Dairy and beef cattle total tract starch D (starch digestion) varies greatly.
  - *Commercial dairy total tract starch D from 2010 and 2014 ranged from approximately 77 to 99% (Rock River Laboratory, Inc. unpublished data).
    - oThis data agrees reasonably well with the 84 to 98% total tract starch digestibility range in dairy cattle digestion presented by Ferraretto and Shaver (2013).
  - *Using NRC (2001) energy equations modified to include total tract starch D within TDN calculation, a 22 unit range could account for approximately 2.7 kg in milk difference.
- Dairy and beef cattle fecal samples are typically taken from commercial dairies and feedlots to assess starch utilization.
  - *Fecal starch content has been related to total tract starch degradation (Ferguson, unpublished; and Ferraretto and Shaver, 2012).
  - *Decreased starch utilization leads to decreased animal performance.
- Fecal sample starch concentration may change during time in transit to analysis laboratory, which in some cases can be five days or more.

Objective:

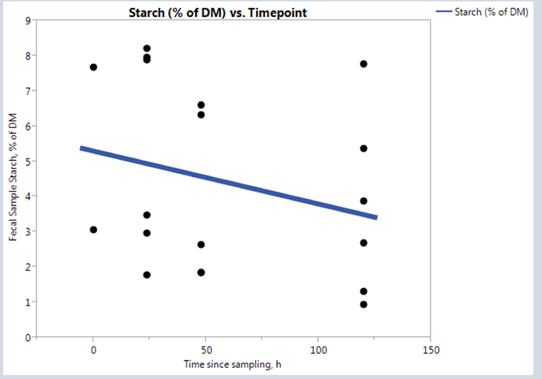
Our objective was to determine if fecal starch concentration changed over time and various temperatures, as to simulate shipping environment.

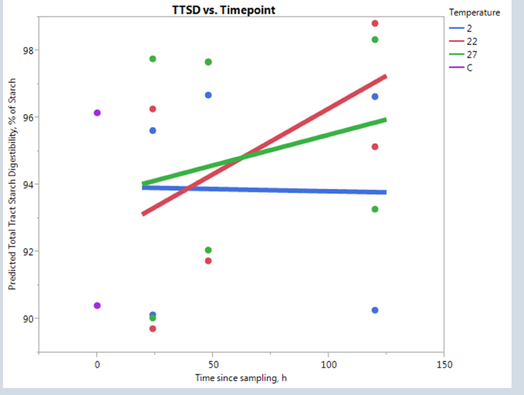
Materials and Methods:

- Dairy cattle fecal samples (at least ten, 250 g subsamples) were collected from manure piles at each of two commercial dairies in Wisconsin, in July 2013.
- Fecal subsamples were thoroughly mixed in a pail and immediately split on-farm, into air tight plastic containers (250 g per container).
  - *Samples were then stored for 0 (control), 1, 2, or 5 d (days)
- Samples stored for 1, 2, or 5 d were also held at approximately 2 degrees C (cold), 22 degrees C (room), or ambient (variable, daily high 27 degrees C) temperatures.
  - *The 0 h sample was processed on the same day samples were gathered.
- These combinations were organized in a factorial arrangement and chosen to simulate sample environment during shipping to analysis lab.
- Samples were oven dried (50 degrees C for 48 h) and ground to 1 mm following treatment.
- Starch content (% of DM) was measured in each sample (Hall, 2008).
- Predicted Total Tract Starch Digestibility (TTSD, % of starch) was calculated using the Ferraretto and Shaver (2012) equation:
  - *100 X (0.9997 - 0.0125 × fecal starch content, % of DM)
- Data were analyzed with multiple linear regression using SAS JMP v10 and model effects chosen using forward selection.
  - *Temperature and time were entered as fixed effects and farm was entered as a random variable.

Results and Discussion:

- Temperature ($P<0.05$) and time ($P<0.01$) were significantly related to fecal starch content and predicted TTSD.
  - *Final model parameter slope estimates were:
    - -0.017 per h for fecal starch
    - 0.020 per h for TTSD
- Fecal starch content averaged 4.3, 5.4, 4.3, and 4.1 % for control, cold, room, and ambient temperature exposures, respectively.
  - *The numerically greater starch content at cold-storage temp relative to control was unexplained.
  - *Plotting predicted TTSD (based upon fecal starch content) over time and separating by temperature revealed that cold-storage appeared to numerically remain unchanged over time.
    - oDegrees of freedom limited testing this interaction
  - *Results warrant further evaluation.
- Fecal starch content raw data averaged 5.4 and 3.7% at 0 and 5 d, respectively.
- Predicted TTSD data averaged 93.3 and 95.4% at 0 and 5 d, respectively.





Conclusions:

- Results suggest fecal sample starch content and total tract starch digestion predictions will change during extended time in transit.
- The amount of time between sampling and starch analysis should be considered and minimized.
- Maintaining cold storage during shipping may limit microbiological starch degradation.

References:

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