ROCK RIVER LABORATORY, INC.
AGRICULTURAL ANALYSIS

TECHNICAL BULLETIN

Exploration of Laboratory Drying Methods

Background
Laboratory procedures and processing vary depending on sample dry matter and desired analyses, but solid sample preparation across the biological industries typically begins with drying and/or grinding of samples to reach a homogeneous material suitable for analysis. The end goal of sample preparation is to accurately represent the entire feed, in its original state. The National Forage Testing Association (NFTA) recognizes both oven drying and microwave drying as accurate techniques for use in dry matter determination and sample preparation (Undersander et al.,1993).

Overview
The aim of sample drying is to drive off water. When heating a sample to dry it, there are several heating options. Many times, the heat source is determined based on the perceived moisture level of the sample (and in non-solid cases, the chance of spatter or splashing during drying).

Details
Rock River Laboratory utilizes microwave ovens in most forage and feed sample dry matter determination processes. When performing microwave drying, Rock River Laboratory utilizes a low to medium drying intensity, depending on the initial sample dry matter content. This method is defined by drying a sample in the microwave for several 1 to 5 minute intervals, following a strict protocol to achieve approximately 90 percent dry. This drying protocol is sensitive to the feed type and requires a low heat setting to avoid burning the sample. In some cases, this could also mean several stages of drying over the course of 30 minutes to get the sample appropriately dry.

Drying technique is sometimes discussed in relation to rumen starch digestion measures. Since 2014, Rock River Laboratory has employed *in situ* rumen digestion techniques for starch digestion analysis, using both oven and microwave drying methods. This analysis includes sample drying, followed by a 6mm grind to homogenize the sample while retaining grain particle size characteristics in samples with greater than 20 percent Neutral Detergent Fiber (NDF). Grain samples are not ground. Outside of wet chemistry analysis, Rock River Laboratory's Near Infrared (NIR) 0, 3, 7, and 16-hour *in situ* starch digestion calibrations are built on both oven and microwave dried samples, as Rock River Laboratory has observed consistent results utilizing both of these drying methods.

Discussion
Walter et al. (1997) and Kingston and Jassie (1988), as cited by the EPA (2004), provided an outline of microwave-assisted sample preparation methods. Several standard procedures using microwave heating for sample preparation have been developed and approved by the American Society for Testing and Materials (ASTM), Association of Official Analytical Chemists (AOAC), and the U.S. Environmental Protection Agency (EPA).

Focusing specifically on dry matter content accuracy, Rock River Laboratory and the industry have learned through many years of research that forced-air ovens can be inaccurate for fermented feeds. Forced-air ovens are known to evaporate more than water. Acetic acid, other volatile fatty acids, ethanol, and other alcohols will also volatilize to some extent during oven drying. Driving off these compounds, along with water, creates a dry matter measure error. These non-water compounds do have energy for cows, but it's unclear how these inaccuracies within nutrition should be considered. Microwave drying may actually be less egregious at volatilization and could result in better accuracy (Meyer et al., 2015).

Conclusion
Rock River Laboratory will continue its commitment to accuracy by conducting in-house trials and evaluating published research when selecting analysis procedures, including drying methodology.

References:
Meyer, D., L. Nagengast, D. Sawyer, and J. Goeser. 2015. Samples dried with commercial dry matter techniques differ in volatile compound contents. J Dairy Sci, Abstract. E Suppl.

Undersander, D., D. Mertens, N. Thiex. 1993. Forage Analysis Procedures. National Forage Testing Association (NFTA).

Environmental Protection Agency (EPA). 2004. Laboratory Sample Preparation. Multi-Agency Radiological Laboratory Analytical Protocols Manual. Chapter 12. P.1-44.