



## Oven versus Microwave: What is the accepted method for forage dry-down?

Obfuscation. A colorful word that basically means the twisting of truth, usually in support of personal or corporate gain. We live in a world that accepts obfuscation as a matter of course where truth is not considered the highest goal.

There has been some degree of obfuscation related to the best method for dry down of forage for analysis in the laboratory. To be clear, we have a dog in that fight. I have spent over 25 years working to improve the quality of analysis and lab services to the feed industry. While recognizing for many years that our use of microwaves for sample dry-down was not ideal, we did it pragmatically as the nutritional industry demanded same day reporting of results on silages.

The use of microwave drying is an “accepted” method for reducing the moisture of forages. However, just because it is “accepted”, does not mean that it is ideal. In a sample preparation process the ideal is to reduce moisture by minimally impacting the character of the sample. For some analyses, any dry-down impacts the sample and requires it to be handled “as-received” with extraction or analysis occurring on the original sample.

The greatest challenge with micro-wave drying is controlling the process. Samples vary in particle size and consistency as well as moisture content. This requires individualized handling and approach to each sample that is to be dried down. The nature of the dry-down characteristics of a sample are not necessarily understood before the sample is microwaved. When processing large numbers of samples, it becomes extremely difficult to manage the drying process of individual samples. Consider our former approach: a bank of 10 microwaves under a large hood attended to by 3 to 4 technicians who would dry down more than 600 samples in four to five hours. Quality of handling was impacted.

Let’s realize that what may be an accepted method for dry matter determination is not what is suitable for drying a sample for subsequent analysis.

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).

In that same document though it is stated that “The oven temperature must not exceed 60°C or heat-damaged protein will be formed that will affect fiber values.” Try microwaving a forage sample and touching it as you take it out of the microwave. It is a lot hotter than 60° C; in fact, we have measured temperatures often in excess of 80° C.

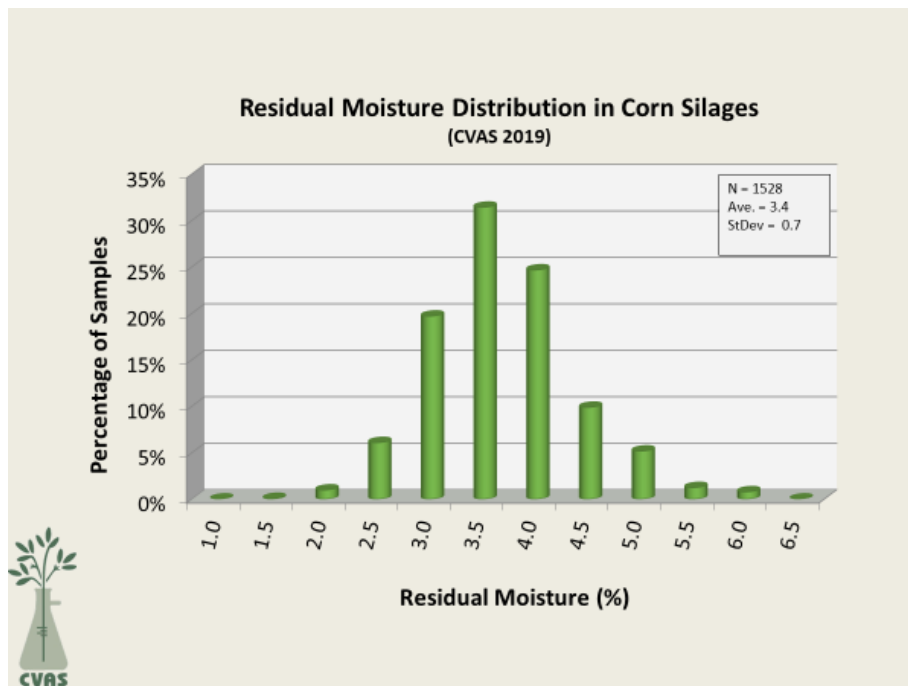
The cited reference was published back in 1993. Maybe we have not progressed much since then, or maybe we have. Several labs in the U.S. and internationally have purchased our innovative HVL-80 drying system. I expect there is a reason for the adoption of that technology. Other labs accept next day reporting of results opting for a quality dry-down at lower moisture levels by drying samples overnight.



Microwave drying of samples came about as a quick and cost-effective method of preparing samples for analysis by a revolutionary new method known as NIR back in the 1970's. Given the crude approach of NIR back then, drying by microwave was the least of anyone's concern. However, it was an approach that allowed NIR to be established in a number of small mom-and-pop labs that was the rough but effective start to the U.S. forage analysis system, propelling the dairy nutritional industry forward.

The need to come up with a better approach to handling larger numbers of samples for rapid dry-down led us to design and build a custom oven for handling the drying of large numbers of samples with minimal impact. This unit, dubbed the "HVL-80" (high-velocity, low-temperature, 80 sample capacity) utilizes a specially designed drying canisters allowing heated air to be drawn up through the sample. The air is heated to a designated 55° centigrade. What makes the unit so effective is that the heated air is dehumidified and recycled back through the unit. Dry air is much more effective at removing moisture than air with a high or ambient level of humidity.

The process of dry-down with the HVL-80 unit is a very controlled process. Samples are uniformly dried to a level of 3% to 5% residual moisture without overheating or burning the sample. The low residual moisture improves the sensitivity of NIR analysis as the "moisture peak" in the near infrared spectrum can occlude spectra of analytical value. Below is a summary of the residual moisture after oven dry-down in recently run corn silages.



Microwave dry-down for NIR analysis may still be an "accepted" practice. However, it is difficult to argue that it is the "best" approach for today's forage laboratory as some have argued when challenged by improved technology.