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Total Dry Matter by Oven Drying for 3 hr at 105 C

1. Application

This procedure is applicable for the determination of dry matter on ground air-dry or partially dried ($\geq$ 85% dry matter) forages with low volatile acid content. This method is often used following lab dry matter determination using method 1.

2. Summary of Methods

Moisture is evaporated from the sample by oven drying. Dry matter is determined gravimetrically as the residue remaining after drying.

3. Safety

Basic precautions regarding mechanical equipment, electric motors, and glassware must be followed. All electrical equipment is properly grounded and installed and maintained by qualified electricians.

4. Interferences

Samples dried by this procedure are not appropriate for subsequent fiber, lignin, or acid detergent insoluble nitrogen analysis. Volatile acids and alcohols may be lost from fermented samples when using this method. This procedure is recommended for developing forage dry matter calibration for NIR.

5. Sample Collection, Preservation, and Handling

All samples are dried at 105 C in a cabinet-type forced air dryer for 3 hrs.

6. Apparatus and Materials

6.1 Forced-air drying oven at 105 C, $\pm$ 3 C. Oven should be equipped with a wire rod shelf to allow the circulation of air. It should be vented and operated with vents open.
6.2 Analytical electronic balance, accurate to 0.001 g.
6.3 Aluminum dish (pan), $\geq$ 50 mm diameter, $\leq$ 40 mm deep.
6.4 Desiccator

7. Reagents

None.

8. Methods

8.1 Dry aluminum dish at 105 C $\pm$ 3 C for at least 2 hours.
8.2 Remove dishes to desiccator. Immediately cover desiccator and allow dishes to cool to room temperature. Do not allow dishes to remain in desiccator more than 2-3 hours.
8.3 Weigh dishes to nearest 0.001 g, removing one at a time from desiccator and keeping desiccator closed between dish removals.
8.4 Add approximately 2 g ground sample to each dish. Record weight of dish and sample to nearest 0.001 g.
8.5 Shake dish gently to uniformly distribute the sample and expose the maximum area for drying.
8.6 Insert samples into preheated oven at 105 C and dry for 3 hours after oven has returned to temperature.
8.7 Move samples to desiccator, seal desiccator and allow to cool to room temperature. Do not allow sample to remain in desiccator for more than 2-3 hours.
8.8 Weigh dish and dried sample, recording weight to nearest 0.001 g.

For NIR calibration replace step 8.4 above with:

8.4.1 Load NIR sample cup placing one scoop of dried and ground sample on each third of the glass surface to ensure that portions of different sub-samples are scanned. Overfill the sample cup and scrape off any excess. Press back into holder until tight and level.
8.4.2 Scan sample in NIR instrument and store spectra.
8.4.3 Immediately remove sample from NIR instrument and weigh 2 g forage from sample cup to aluminum dishes. Record weight of dish and sample to nearest 0.001 g and proceed with steps 8.5 thru 8.8 above.

Notes:

- Time and temperature must be adhered to closely.
- Samples should be placed in drying oven so that air can circulate freely. Containers should not touch.
- Slide the desiccator lid open. Do not place the lid on the countertop with the grease side down. The grease will pick up dirt, preventing formation of a seal.
- Seals should be kept clean and well greased and the lid should always slide easily on or off. If the lid "grabs," it is time to remove the old grease and apply fresh lubricant.
- If a lid can be directly lifted off the desiccator, either the desiccator was not properly sealed or, more likely, it needs fresh lubricant.
- Rubber stoppers in the lid should always be pliable.
- Sample dishes should not be packed excessively tight in the desiccator. Air movement is necessary to cool sample dishes. Dishes should not touch each other.
- Open a loaded desiccator very slowly after samples have cooled. A vacuum forms during cooling and abrupt opening results in turbulence which can blow samples out of uncovered containers.

- Desiccator lid should be slid open for the removal of each container and closed during weighing. Leaving the lid open allows samples to absorb moisture.
- Desiccant should be checked and dried periodically. Replace at least twice annually. Use of desiccant with color indictor for moisture is recommended.

9. Calculations

Percent Total Dry Matter (Total DM):
% Total DM = {(Dry Weight of Sample and Dish – Tare Weight of Dish) / (Initial Weight of Sample and Dish – Tare Weight of Dish)} X 100

Percent Total Moisture:
% Total Moisture = 100 - % Total DM

10. Quality Control

Include at least one set of duplicates in each run if single determinations are being made. An acceptable average standard deviation among replicated analyses for moisture or dry matter is about $\pm$ 0.10 %DM, which results in a warning limit (2s) of $\pm$ 0.20 and a control limit (3s) of $\pm$ 0.30. Plot the results of the duplicated analyses on an R-control chart and examine the chart for trends. Results outside the 95 percent confidence limits warn of possible problems with the analytical system. Results outside the 99 percent confidence limits indicate loss of control, and results of the run should be discarded. If more than five or six points in succession fall on one side or the other of the 50 percent line, it is a strong indication that something has changed and is cause for investigation.

11. Reporting

Results are reported as % Total Dry Matter and % Total Moisture.

12. References

NFTA, 2001. Moisture task force report.