

Evaluation of On-Farm Forage Dry Matter Determined by Near Infrared Spectroscopy

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Introduction

- Near infrared spectroscopy (NIRS) is a useful method for determining forage and grain nutrient composition
- Increasing the frequency of DM content analysis for forages may increase consistency of the ration
- Portable on-farm NIRS allows rapid determination of forage DM content with little sample preparation

Objective

- Evaluate the use of NIRS for on-farm measurement of forage DM content and compare to a standard oven DM method

Materials and Methods

- AgriNIR[™] portable NIRS analyzer (Dinamica Generale, Mantova, Italy)
- NIRS calibrated to on-farm corn silage (CS) and alfalfa silage (AS)
 - Scanned 10 samples each of corn silage and alfalfa silage using NIRS to obtain spectral analysis
 - Samples sent to a commercial laboratory (Dairyland Laboratories, Inc., Arcadia, WI) for DM using two step method of microwave drying to 90-95% DM, then use laboratory NIRS to measure total DM content
 - Spectral analysis and laboratory DM analysis were used to update calibration equations for each forage
- Obtained samples of corn silage and alfalfa silage twice weekly on the same two days of the week for 11 weeks
 - Total of 94 CS samples from 6 silo bags and 2 bunker silos
 - Total of 20 AS samples from 1 bunker silo
- NIRS DM
 - Samples (60-100 g) were compressed into the sample tray and scanned using the portable NIRS by moving the tray back and forth in the scanning chamber for 10 seconds
 - The samples were removed from the sample tray and frozen at -20° C until oven DM determination
- Oven DM
 - The entire sample previously run on the NIRS was used
 - Sample DM content was determined by drying in a forced-air oven at 60° C for 48 h
- Bias was calculated as the difference between oven and NIRS DM
- Regression of the NIRS vs. oven DM was performed for each forage

Results

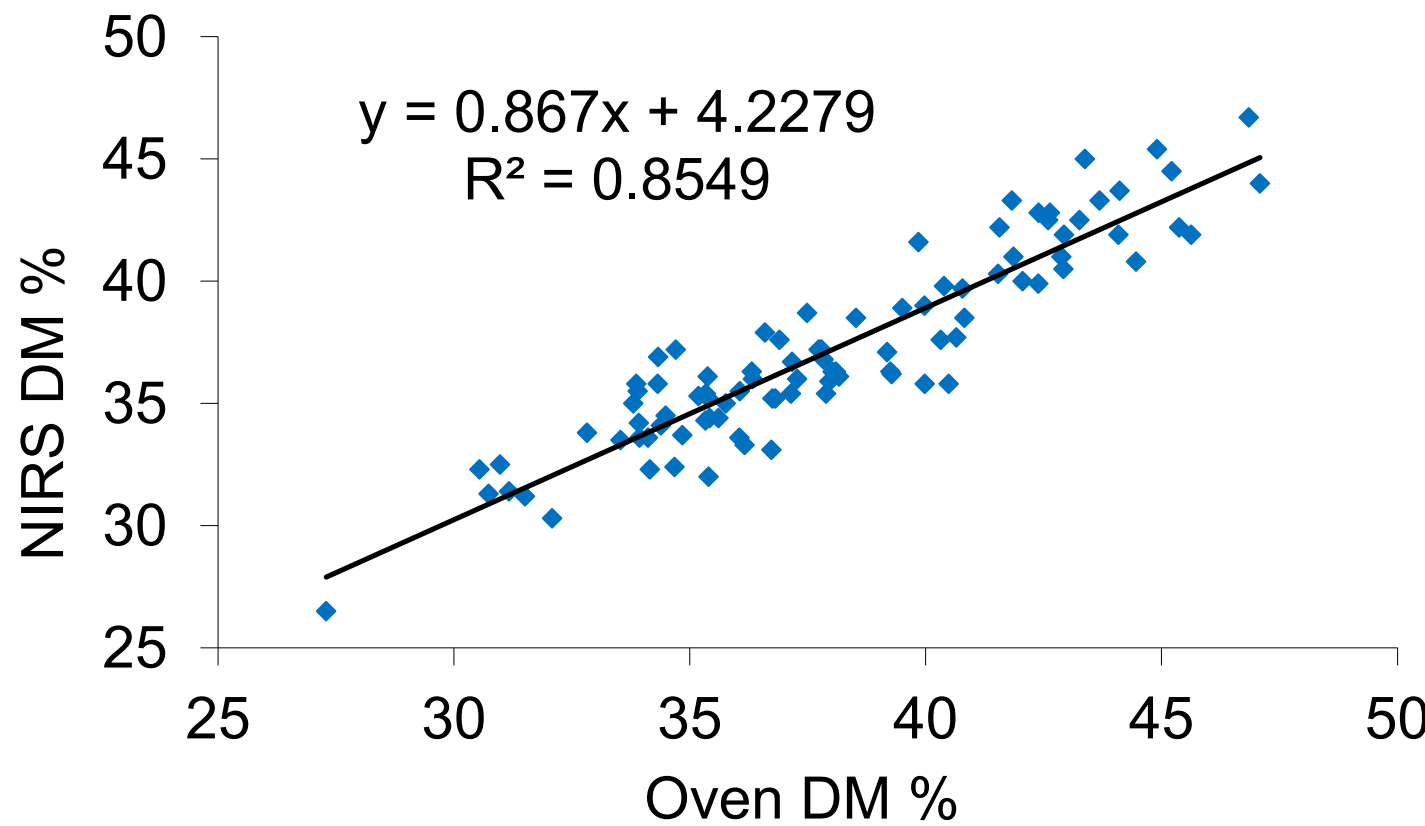


Figure 1. Regression of Oven vs. NIRS DM for corn silage

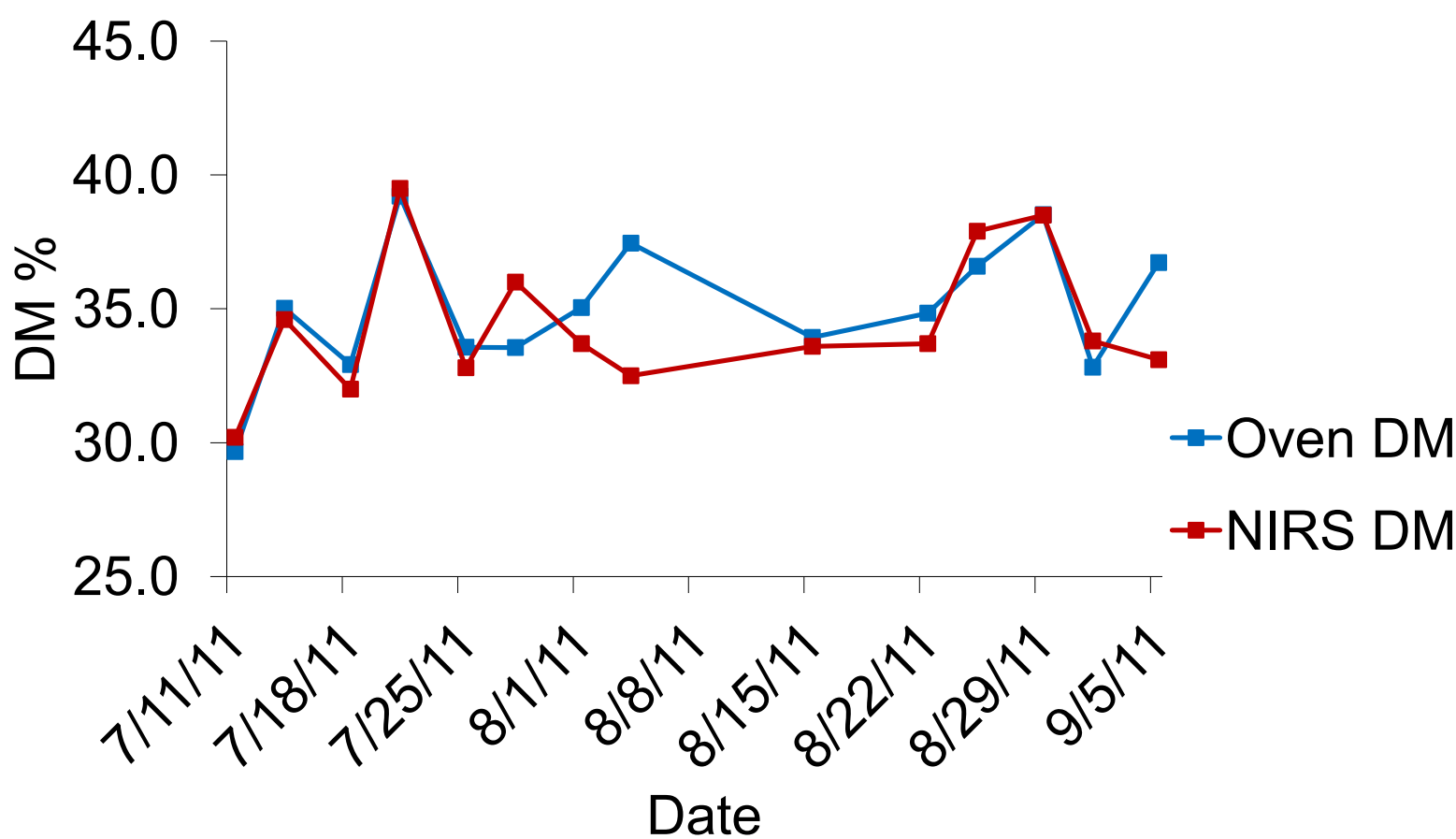


Figure 3. Corn silage DM over time of one bunker

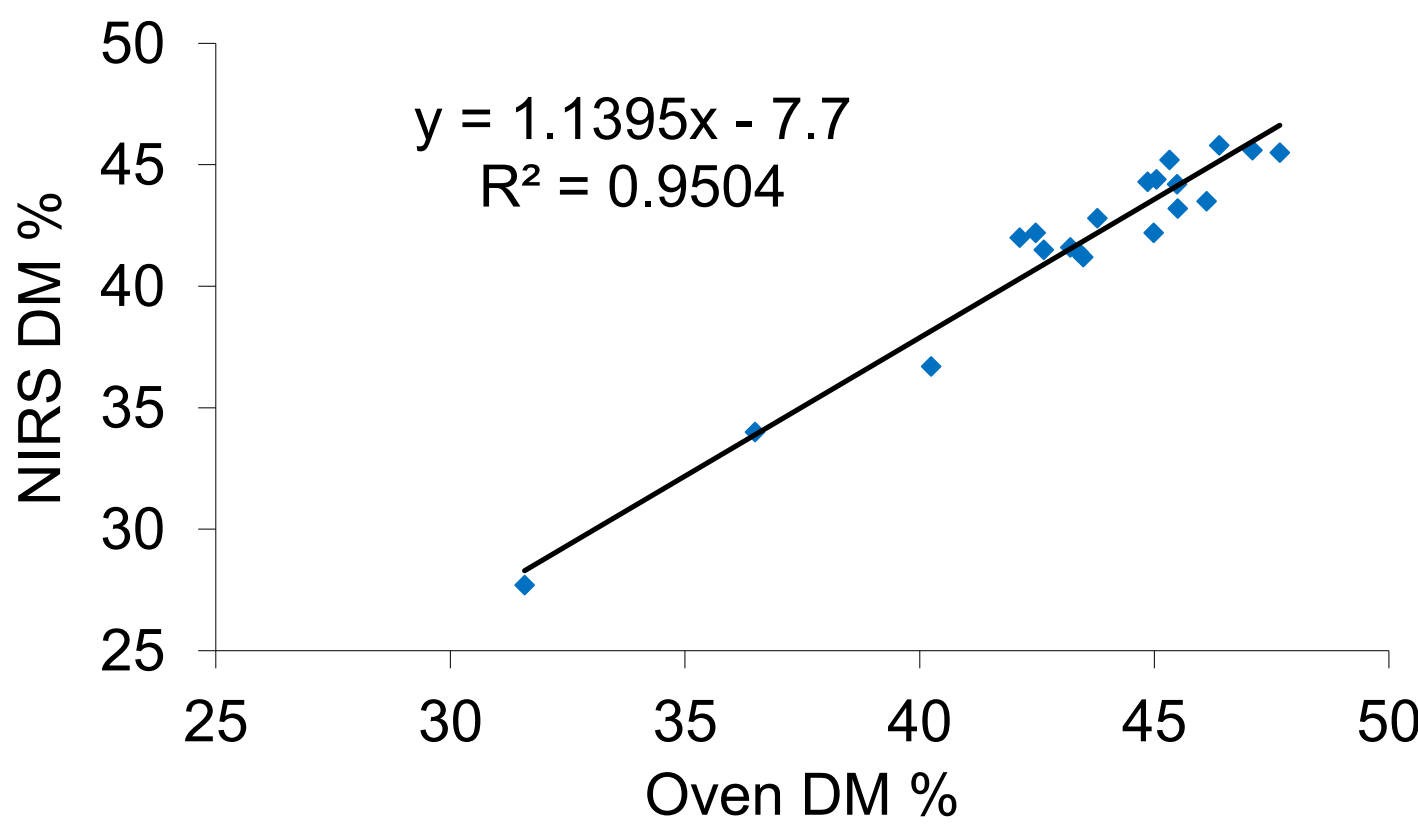


Figure 2. Regression of Oven vs. NIRS DM for alfalfa silage

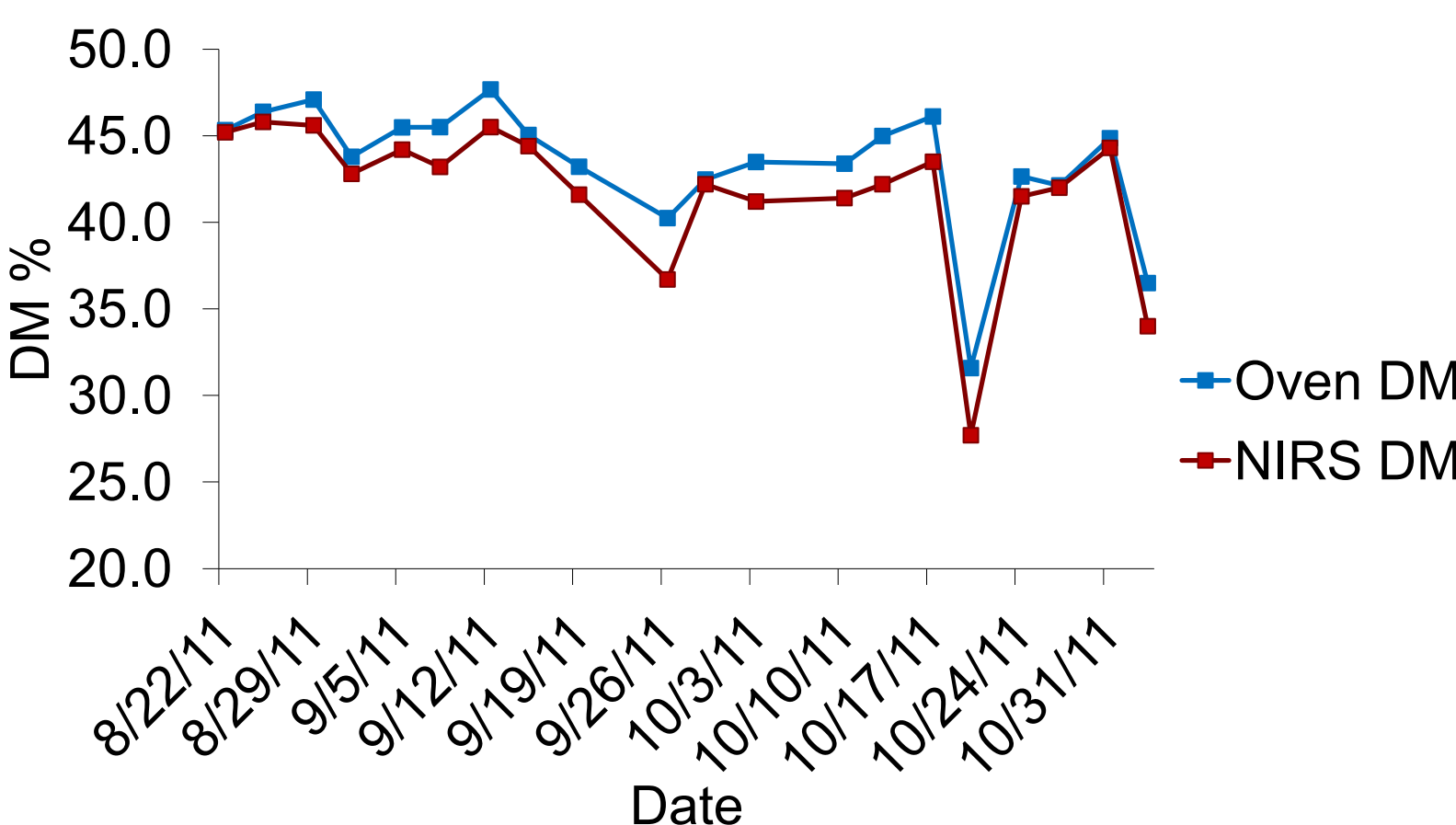


Figure 4. Alfalfa silage DM over time of a bunker

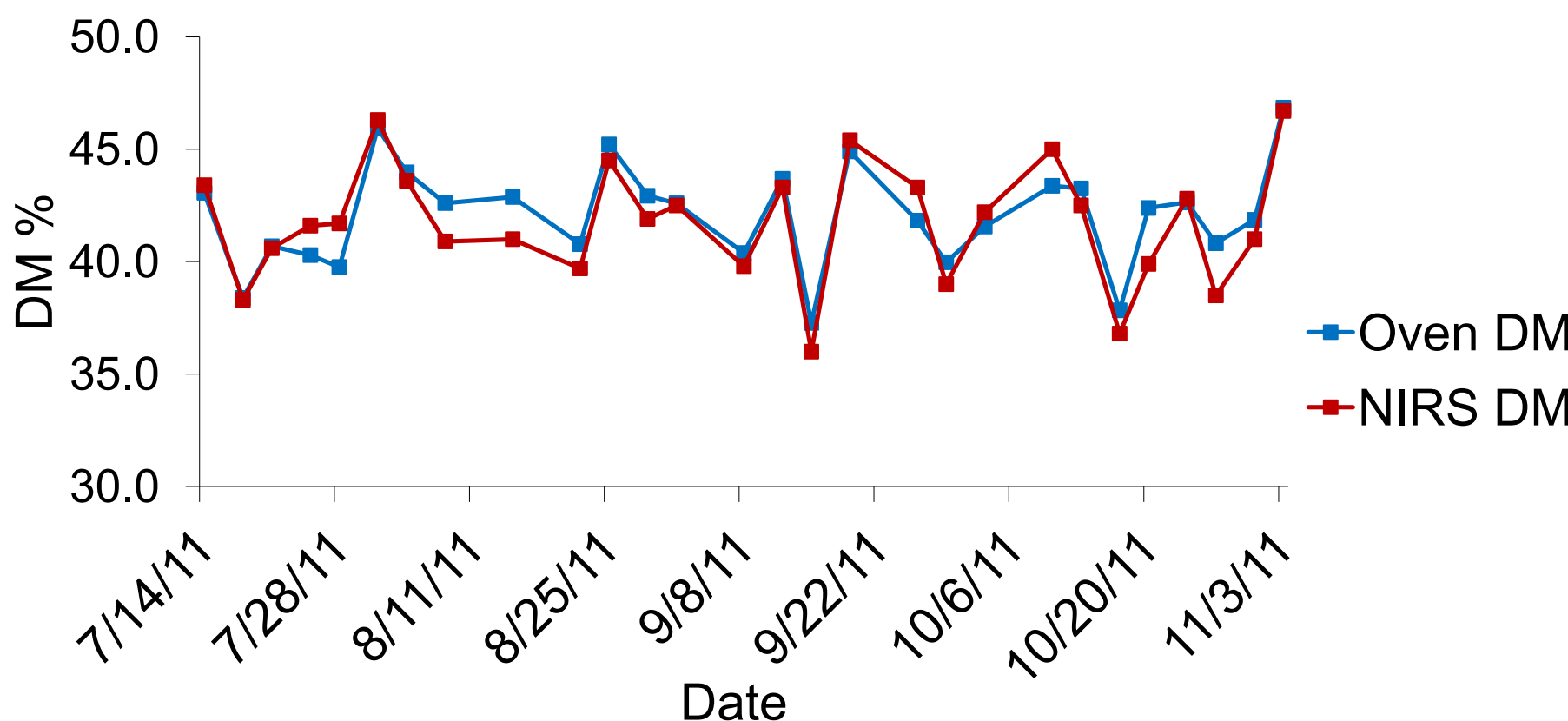


Figure 5. Corn silage DM over time of one silage bag

Table 1. Dry matter contents of corn silage and alfalfa silage using oven or NIRS

Item	Corn Silage	SD	Alfalfa Silage	SD
Mean Oven DM, % as fed	38.1	4.2	43.4	3.8
Mean NIRS DM, % as fed	37.2	3.9	41.6	4.4
Mean Bias (oven-NIRS), % units	0.8	1.6	1.6	1.1
Oven Maximum DM, % as fed	46.7	-	47.7	-
NIRS Maximum DM, % as fed	47.1	-	45.8	-
Oven Minimum DM, % as fed	27.3	-	31.6	-
NIRS Minimum DM, % as fed	26.5	-	27.7	-

Summary

- Mean oven DM for CS was 0.8% units greater than NIRS DM
- Standard deviation of bias for CS was 1.6% units
- NIRS was accurate but had more variation over time for CS
- Mean oven DM for AS was 1.6% units greater than NIRS DM
- Standard deviation of bias for AS was 1.1% units
- NIRS DM was consistently lower than oven DM for AS
- Regression of oven vs. NIRS DM had R² of 0.85 for CS and 0.95 for AS
- NIRS DM followed the oven DM over time even when DM content had large changes (Figures 3-5)

Conclusions

- Portable NIRS was able to accurately predict DM content of corn silage and alfalfa silage compared to oven DM
- Portable NIRS is a useful tool to increase the frequency of on-farm DM analysis for improving consistency of ration DM over time