Use of an air fryer to determine dry matter in forage and diets for dairy cattle

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Dry matter (DM) can be defined as the remaining portion of a forage or feed after moisture has been removed by forced drying. DM determination is commonly performed in the laboratory, but because it is a very important parameter when making silages, hays, haylage and balancing livestock diets, it is also a common practice on dairy farms.

The most common and practical method to determine DM on farms is to use the Koster moisture tester with the microwave technique. Even near-infrared spectroscopy (NIRS) equipment is sometimes used. These devices accurately determine DM in forages, feeds and diets. However, there is the possibility results may have errors if the person in charge of determining DM is not properly trained. Additionally, the cost of the Koster moisture tester and NIRS can be high.

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One disadvantage of the microwave is that the sample drying process is slow and tedious, and if recommended steps are not followed, there is risk the sample will either not dry completely or incinerate; so, similar results as those obtained in the lab are not obtained. Therefore, there is a need to use a device that determines DM precisely, in as short a time as possible, that is economical, and that anyone on the farm can use.

Using an air fryer

The air fryer is a small convection oven designed to fry food without oil. The fryer has a heating mechanism and a fan that circulates hot air. It consists of an air inlet at the top and an exhaust at the back that controls the temperature by releasing excess hot air. Air circulates around the food placed in a frying-style basket (**Figure1**).

FIGURE 1 Air fryer

The circulation of hot air causes food to lose moisture and be crisp. This fryer mechanism looks like forced-air ovens used in laboratories to determine DM in forage and feeds. For this reason, a residential air fryer could be used to determine DM contents of forage and feeds in dairy farms in a practical and expeditious way.

The use of an air fryer to easily determine DM was first presented by the University of Delaware at the 2018 U.S. World Dairy Expo. They used the fryer to evaluate DM in dairy cow diets. However, there are many other important activities on the farm where DM content needs to be analyzed. For example, the correct DM content to which forage should be ensiled or hayed, the DM concentration of silage or haylage to adjust the diet DM, and DM from diets to estimate animal feed intake.

Because of this, this research group decided to test an air fryer to determine DM content of different type of samples on dairy farms.

Testing the air fryer on the farm

The most reliable way to test the effectiveness of an air fryer is through research. As a result, work was carried out jointly between INIFAP-CELALA, FAZ-UJED and Dellait Dairy Research Center to measure the effectiveness of the air-fryer method to determine DM in

forage and dairy cattle diets on dairy farms of the Comarca Lagunera region in Mexico.

The study was conducted during 2019-20 contrasting air fryer (PowerXL) DM results against DM results obtained from a forced-air oven and a microwave. DM was analyzed in forage corn samples at harvest time, triticale and alfalfa haylages, and in diets for heifers and cows in production.

The results of the study indicated there was no statistical difference (p greater than 0.05) in the DM contents of forage and diets between the air fryer, microwave and forced-air oven (**Table1**). This shows that air fryers can be as reliable in determining DM for forage and diets on the farm as forced-air ovens and microwaves.

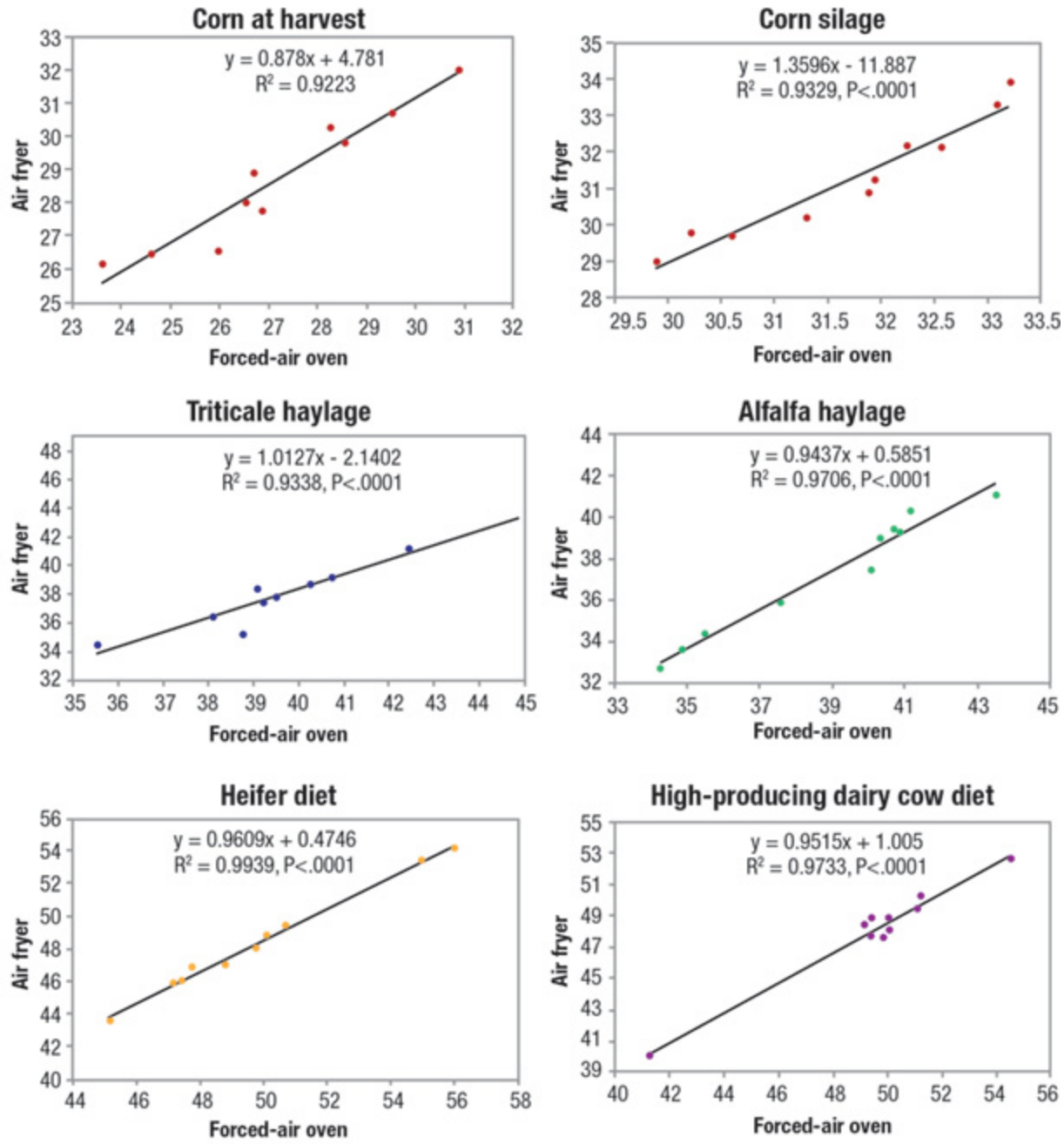
TABLE 1 Comparison of forage and diet DM between the forced-air oven, microwave and air fryer

Sample type	Forced-air oven	Microwave	Air fryer	SE	P value
Fresh corn forage at harvesting	37.37	39.09	39.02	2.06	0.12
Corn silage	31.70	31.54	31.21	1.44	0.75
Triticale haylage	39.94	39.09	38.31	2.86	0.45
Alfalfa haylage	38.89	38.67	37.28	3.15	0.47
Hiefer diet before breeding	49.78	49.50	48.30	3.30	0.57
High-producing cow diet	49.58	48.51	48.10	3.27	0.61

SE = standard error

A regression analysis was performed to confirm the similarity between the air fryer and forced-air oven to estimate DM content. The analysis showed there is a strong relationship with a high degree of reliability between the ability of the two devices to determine DM content in forage and animal diets on the farm (**Figure 2**). Therefore, air fryers can estimate DM concentration in forages and diets for dairy cattle with a high degree of accuracy.

FIGURE 2 Relationship between the air fryer and the forced-air oven in determining DM contents of forage and diets for dairy cattle



The closer to the line are the colored dots, the greater the accuracy.

One important aspect is the cost comparison of these devices and the time employed to determine DM with each of them (**Table 2**). Because the forced-air oven is a laboratory instrument, its cost drastically surpasses that of the air fryer and microwave.

TABLE 2 Price and time required to determine DM with the different devices

Equipment	Price (USD)	Sample size (g)	Time required for analysis
Forced-air oven	More than 15,000	100-700	72 hours
Microwave oven	20-200	100-200	25-35 min
Air fryer	75-200	100-150	25-30 min

The time required for DM determination between the air fryer and the microwave is very similar. However, the steps and activities performed to obtain DM with the microwave are more and need to be done every two or three minutes. Therefore, the technique using the microwave is tedious and is more likely to get erroneous results.

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PHOTO: *Courtesy photo*.

How to use an air fryer to determine DM

Since an air fryer uses air for sample drying, it is recommended to use a welded metal mesh placed inside the basket on top of the sample. This mesh must be of the size of the inner diameter of the basket. The mesh prevents very small sample particles from being lost during the drying process.

The procedure for determining dry matter is as follows:

- Get the tare from the air fryer basket, including the mesh.
- Add between 100-150 grams of representative sample to the basket.
- Place the mesh over the sample.
- Place the basket inside the air fryer.
- Set the air fryer temperatures to 250ºF (121ºC).
- Set the timer for 25-30 minutes..
- After the scheduled time, remove the basket with the sample and mesh.
- Record the weight.
- Calculate the DM of the sample: DM (%) = Final dry weight (grams) / Initial wet weight (grams) X 100

Note:

- It is advisable to clean the basket with a brush after analyzing each sample to avoid contamination between samples and deterioration of the basket’s Teflon coating.
- It is recommended to use a digital scale with precision of 0.1 grams and a maximum capacity of 5 kilograms.