

# Measuring Potato Dry Matter Content on the Farm

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## Introduction

CULL POTATOES ARE AVAILABLE for sale to livestock producers during years with low potato prices or when harvested potatoes fail to meet quality standards. Potatoes are mostly water (75 to 85%), and the water content varies with variety, maturity, growing location, seasonal effects, fertilization program, and storage conditions. In addition, cull potatoes are typically not stored in a controlled environment and will lose moisture over time due to suboptimal humidity and temperature conditions.

The feed nutrients are found in the dry matter portion of the potato, not in the moisture portion. Dry matter refers to the material remaining in the potato after removal of water, and the moisture content is the amount of water in the potato.

Knowing the dry matter content of cull potatoes is important because it affects the feeding rate and the dollar value of cull potatoes (table 1). Fewer pounds of high-dry-matter potatoes are needed to achieve a specific level of dry-matter intake than of low-dry-matter potatoes. For example, cattle eat 5 pounds of potato dry matter whether they consume 20 pounds

of 25% dry matter potatoes or 33 pounds of 15% dry matter potatoes.

High-dry-matter potatoes have a higher dollar value per hundredweight since they contain more pounds of dry matter in every hundred pounds of potatoes. If we assume cull potatoes are priced at \$0.10 per pound of dry matter, then potatoes with 15% dry matter are worth \$1.50 per hundredweight (100 pounds  $\times$  15%  $\times$  \$0.10/pound of dry matter = \$1.50) and 25% dry matter potatoes are worth \$2.50 per hundredweight.

Knowing the dry matter of cull potatoes is therefore important to both the potato grower and to the livestock producer for establishing a price for cull potatoes. Several methods for assessing dry matter in potatoes are available, ranging from those in a commercial laboratory to relatively simple and quick on-farm methods. Whichever method they choose, the buyer and seller will need to agree on the method and how to use the results to set the price.

This publication describes three on-farm methods for measuring potato dry matter that provide similar results to commercial laboratory tests. The cost per analysis is less for on-farm methods than for sending a sample to the lab and paying lab fees.

## Sampling and processing cull potatoes

To accurately determine dry matter, collect a representative sample of potatoes from the pile of cull potatoes. Select a potato at each of five locations, then process the five potatoes by either slicing them or cutting them into French fries. Mix the processed potatoes together, then weigh out a 50- to 100-gram sample for drying (approximately 1/8 to 1/4 pound). The size of the

**Table 1.** Relationship between potato dry matter percentage, dry matter content per hundredweight, and dollar value of cull potatoes.

Cull potato dry matter (%)	Dry matter in 100 pounds of cull potatoes <sup>1</sup> (pounds)	Value of cull potatoes <sup>2</sup> (\$/hundredweight)
15	15	1.50
20	20	2.00
25	25	2.50

<sup>1</sup>Calculated by multiplying dry matter percentage by 100 pounds.

<sup>2</sup>In this example, potatoes are valued at \$0.10 per pound of dry matter.

subsample is dependent on the drying equipment. An accurate scale that reads in grams or tenths of grams is important to ensure accuracy in the calculations.

## Drying methods

Several different methods are available to dry potatoes, each with advantages and disadvantages. An overview of the various methods is provided below.

### Forced-air oven

The standard method for measuring dry matter in a commercial feed testing laboratory involves the use of a forced-air oven. Feed samples are typically dried for 24 hours at 100° to 105°C (212° to 221°F). Forced-air ovens are quite expensive relative to a typical residential home oven. One could measure potato dry matter with a kitchen oven, but it would be inconvenient due to the long heating time and the results would be less accurate than with a forced-air, laboratory oven.

### Microwave

Microwave ovens provide a relatively quick means of drying potatoes and are available in most home kitchens. The greatest challenge with the use of a microwave is the possibility of burning the sample during drying. Constant monitoring and short drying intervals (30 seconds to 1 minute) are necessary to minimize the risk of burning.

Drying time will vary depending on microwave power, sample size, and potato slice or fry thickness. High-wattage microwaves will dry samples quicker than microwaves with lower power ratings. Fifty-gram samples will dry faster than 100-gram samples. Thin slices will dry faster than thick slices (table 2).

Potato pieces should be similar in size because smaller pieces will dry out quicker than large pieces and may burn if the microwave is run for too long a time. Dry matter results tend to be similar between a forced-air, laboratory oven and a microwave, but microwave results will be lower if the sample burns during drying.

### Food dehydrator

Many homes have a food dehydrator for preparing dried fruits and meat jerky. Food dehydrators dry potato samples slowly, with no risk of burning. This method requires minimal operator attention during the drying process and takes about 3 to 8 hours, depending

on potato processing method. Drying times are shorter when the potato sample is sliced thinly or processed into French fries (table 2). Dry matter results with a dehydrator are within 1 to 2 percentage units of laboratory-oven values.

### Koster Moisture Tester

Many livestock operations have a Koster Moisture Tester on hand to test dry matter of chopped corn or alfalfa prior to ensiling, and it can be used to measure dry matter content of potatoes. A Koster tester is an electrical appliance that blows heated air through a screen on which the feedstuff is placed. The heating element in the Koster Moisture Tester is well protected but does get red hot during the drying process. For safety purposes, place the Koster tester where it will be undisturbed during the drying process. Some farms use timers to turn off the Koster tester so that they can do other tasks while the feed dries.

Drying potatoes with a Koster Moisture Tester is relatively slow, and drying times depend on potato processing method. In our testing, 1/4-inch-thick slices required significantly more time to dry than samples processed into 1/4-inch French fries (table 2). Dry matter results are similar between the Koster tester and laboratory ovens.

**Table 2.** Typical sample drying times with three on-farm methods for determining cull potato dry matter.

Processing method	Average (minutes)	Range (minutes)
<b>Microwave oven, 1,100 watt</b>		
1/4 inch slices	8.7	8 to 10
1/8 inch slices	7.0	6.5 to 7.5
1/10 inch slices	3.4	3 to 4
<b>Food dehydrator</b>		
1/4 inch slices	459	450 to 510
1/8 inch slices	210	180 to 240
1/4 inch fries	264	240 to 300
1/8 inch fries	225	210 to 240
<b>Koster Moisture Tester</b>		
1/4 inch slices	243	210 to 300
1/4 inch fries	142	120 to 180

# Calculating Dry Matter

## Food Dehydrator and Koster Moisture Tester

1. Weigh the empty food dehydrator tray or the metal basket for the Koster Moisture Tester and record the weight.
2. Place 100 grams of processed potatoes in the container (tray or basket). Weigh and record the container and raw potato weight.
3. Dry the potato sample in the dehydrator or Koster Moisture Tester. Use the average drying times in table 2 as the initial drying period.
4. Weigh the container with its sample and return it to the drying device for another 30 minutes.
5. Weigh again, and if the total weight is the same or within 0.5 grams, you're done. If not, repeat drying for another 30 minutes.
6. Subtract the weight of the container from the final weight (step 5) to determine the weight of the potatoes after drying.
7. Divide the weight of the dry potatoes (step 6) by the weight of the raw potatoes (step 2).
8. Multiply by 100 to obtain dry matter content in percent.

### Example:

Container weight = 300 g  
Container and sample weight before drying = 400 g  
Wet sample weight = 100 g (Calculation: 400 g – 300 g = 100 g)  
Container and sample weight after drying = 320 g  
Dry sample weight = 20 g (Calculation: 320 g – 300 g = 20 g)  
Dry matter = 20% (Calculation: 20 g/100 g = 0.20 x 100 = 20%)

## Microwave

1. Weigh a microwave-safe plate and record the weight.
2. Place 50 grams of processed potatoes on the plate.
3. Weigh the plate and raw potato and record the weight.
4. Dry the potato sample in the microwave for 30 seconds, then weigh the plate and sample.
5. Return to the microwave and dry for another 30 seconds; weigh the plate and sample.
6. Repeat until the weight of the plate and sample is the same or within 0.5 gram of the previous weight and record the weight. Watch the potatoes closely during the drying process. If they start turning light brown, they are dry or very close to dry. Shut off the microwave immediately if they start smoking. You will need to retest if any of the sample pieces burned during the drying process.
7. Subtract the weight of the container from the final weight (step 6) to determine the weight of the potatoes after drying.
8. Divide the weight of the dry potatoes (step 7) by the weight of the raw potatoes (step 2).
9. Multiply by 100 to obtain dry matter content in percent.

### Example:

Plate weight = 300 g  
Plate and sample weight before drying = 350 g  
Wet sample weight = 50 g (Calculation: 350 g – 300 g = 50 g)  
Plate and sample weight after drying = 310 g  
Dry sample weight = 10 g (Calculation: 310 g – 300 g = 10 g)  
Dry matter = 20% (Calculation: 10 g/50 g = 0.20 x 100 = 20%)

## About the Authors

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