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# Factors Affecting Efficacy Of Dry Aging Of Beef (#329)

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Notes

## Introduction

During dry aging, water is transferred from the interior to the meat surface and is subsequently evaporated and flavor compounds are concentrated. Temperature, air flow, relative humidity (RH), and pH are important variables of the drying process because they can affect the water evaporation rate.

If RH is too low, excess product shrinkage and crust formation may occur. Conversely, high RH causes slow drying and prevents crust formation. We hypothesized that rapid drying due to low RH would create a hard crust on the meat surface that could reduce moisture loss, negatively affecting flavor and yield. Meat pH affects the ability of muscle to bind water. Therefore, we evaluated pH effects on water loss. Dry aging of dark cutters (DC) beef may improve flavor and increase yield.

## Methods

We have built a computerized dry aging system that is capable of precisely controlling RH (± 1%) and fan speed (± 50 RPM). The chambers have built-in weighing scales that can continuously monitor weight loss (± 5g). Fan speed, RH, weight and temperature can be saved on the connected computer in intervals of 1 s.

Project 1: Sixteen USDA low Choice boneless strip loins were assigned to one of four aging treatments: vacuum (Wet), dry-aging at 50% RH (RH50), dry-aging at 70% RH (RH70), or dry-aging at 85% RH (RH85). Loins were placed in individual dry aging chambers and aged for 42 days at 1°C and 2200 RPM fan speed.

Project 2: Six USDA low Choice and six matching DC carcasses were selected and boneless strip loins from both sides were obtained. Longissimus muscle pH was measured and carcasses were classified as DC (pH = 6.69), or control (pH = 5.47). Then, both strip loins per animal were assigned to 2 aging methods (wet or dry). The 4 treatments included 2 dry aging (DRY and DRY-DC) and 2 wet-aging treatments (WET and WET-DC). Loins were aged for 42 d at 1°C, 70% RH, and 2200 RPM fan speed.

After aging, loins were fabricated into steaks and evaluated for aging losses (trim loss and yield), Warner-Bratzler shear force (WBSF), and by sensory analysis via triangle test. Samples from the project 1 were also evaluated by a sensory profile panel. Trained panel results were analyzed using PROC GLM and principal component analysis (PCA). Rate of moisture loss was analyzed as a split plot design with treatment as the main plot and days of aging as the repeated measures. All the other data were analyzed as a completely randomized design. Chamber (loin) was considered the experimental unit. Data were analyzed using the PROC GLIMMIX procedure of SAS with = 0.05.

## Results

Project 1: There was a treatment by day interaction for rate of moisture loss ($P < 0.001$; Figure 1). The RH50 treatment had a faster rate of moisture loss than RH85 on the first day of aging ($P < 0.05$), while RH70 was intermediate. The RH50 and RH70 treatments had higher rates of moisture loss than RH85 on days 2 and 3 of aging ($P < 0.05$). By day 4, no differences in rate of moisture loss among RH treatments were found ($P > 0.05$). Wet-aged samples had lower moisture loss, trim loss and higher yield than all dry-aged treatments ($P < 0.05$). However, there were no differences among RH treatments for total moisture loss ($P = 0.66$), trim loss ($P = 0.96$) and yield ($P = 0.90$). No differences among treatments for WBSF were found ($P = 0.66$). Results from the triangle test indicated that there was a detectable difference between Wet and RH70 ($P = 0.02$). However, there was no detectable difference between RH50 and RH85 ($P = 0.14$). No differences among treatments were found for flavor notes using analysis of variance. Using PCA, two factors explained 83% of the variation in sensory attributes. The RH50 treatment tended to be associated with relatively positive flavor notes, including beef flavor ID, roasted, umami, smokey/charcoal, heated oil, bitter, and brown flavor. The RH70 treatment tended to associate with sour milk, sour aromatics, rancid and fishy flavor, while RH85 tended to associate with oxidatized flavors like cardboard, warmed-over, metallic, green, liver-like and sour flavor notes. Wet aged steaks were fairly neutral in flavor notes (Figure 2).

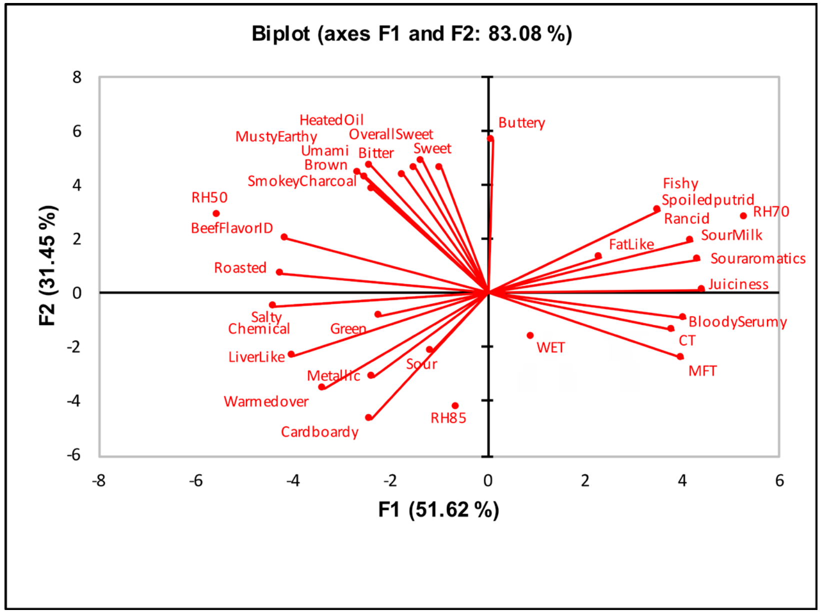
Project 2: No differences in rate of moisture loss ($P = 0.51$), total moisture loss ($P = 0.96$; Figure 3), trim loss ($P = 0.69$) or yield ($P = 0.75$) between DRY-DC and DRY were found. There were no differences among treatments for WBSF ($P = 0.67$). Results from triangle testing indicated a detectable difference between DRY-DC and DRY ($P = 0.01$), DRY-DC and WET-DC ($P = 0.01$), DRY-DC and WET ($P = 0.01$) and WET-DC and WET ($P < 0.01$). Anecdotally, panelists noted inferior eating satisfaction associated with DC flavor, although they were not asked questions regarding preference.

## Conclusion

Lower RH results in more rapid moisture loss at the beginning of the aging process without significantly affecting the total amount of moisture loss.

Flavor notes tended to be more desirable than other treatments. Ultimate pH did not affect the rate and total moisture loss in dry aged beef. Trim loss, yield, and tenderness were not affect by RH or ultimate pH during dry aging.

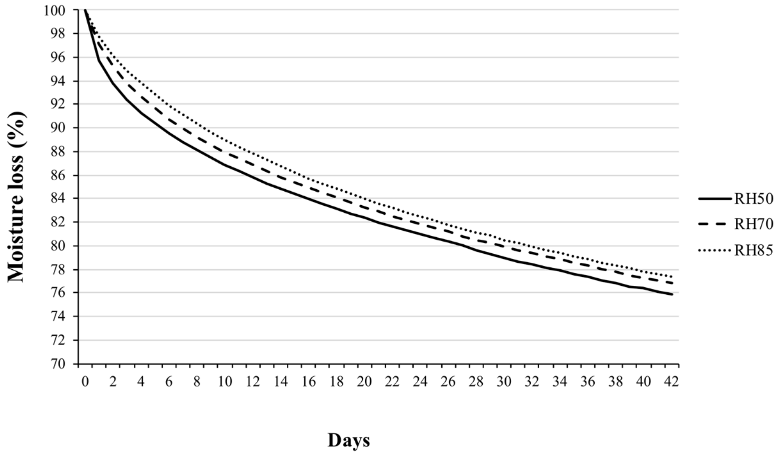
Results suggest that dry aging did not improve flavor characteristics of DC beef.



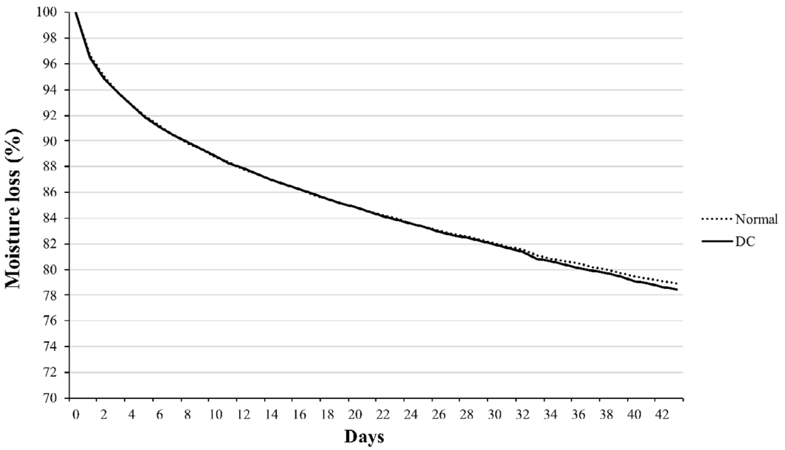

**Principal component biplot of sensory attributes**

**Figure 2.** Principal component biplot of sensory attributes where RH50 = dry aged loins at 50% relative humidity (RH), RH70 = dry aged loins at 70% RH, RH85 = dry aged loins at 85% RH, and WET = wet aged loins for trained sensory panel.

Notes




**Moisture loss over time**
**Figure 1.** Total moisture loss of boneless strip loins (*Longissimus lumborum*) dry aged for 42 days at 50, 70 or 85% relative humidity (RH).




**Moisture loss over time**
**Figure 3.** Total moisture loss of boneless strip loins (*Longissimus lumborum*) classified as dark cutters (DC) or normal ultimate pH dry aged for 42 days.

Notes