SCAA Member-Driven Research

Coffee Staling Report

By Emma Bladyka, SCAA Coffee Science Manager

SPECIALTY COFFEE ASSOCIATION OF AMERICA®

The Specialty Coffee Association of America (SCAA) is a non-profit trade organization and the world recognized leader in coffee knowledge development. With over 9,000 members located in more than 40 countries, including member companies and their employees, SCAA members represent every segment of the specialty coffee industry, including producers, roasters, importers/exporters, retailers, manufacturers, baristas and other industry professionals. For over 30 years, the SCAA has been dedicated to creating a vibrant specialty coffee community, recognizing, developing and promoting specialty coffee by setting and maintaining quality standards for the industry; conducting research on coffee consumption, brewing and perfection of craft; and providing education, training, resources and business services for its members.
Visit www.scaa.org.

Table of Contents

Introduction

In food science, coffee is known as a shelf stable product. This is because unlike many other food products, it does not spoil due to enzymatic or microbial processes (Nicoli and others 1993; Illy and Viani 2005; Anese and others 2006). However, the specialty coffee industry recognizes the importance of chemical reactions and physical changes that occur after roasting, and are aware that some of these changes are responsible for staling (Nicoli and others 2009). The staling rate of coffee can be defined as the perceptible amount of negative flavor change over a given amount of time. This rate can be utilized to determine a shelf life for roasted coffee. Shelf life is an individual set point that must be based on individual company best practices. Because coffee does not spoil, shelf life best practices must be based on a loss of quality measured by sensory methods. However, capturing the exact nature, quantity, and rate of staling is inherently challenging due to both the diversity of flavors possible in the bean itself and to the volatility of delicious flavor and aroma compounds that contribute to the ephemeral nature of roasted coffee.

Defining the science behind staling is problematic. The chemical and physical changes that occur in coffee after roasting make experimental control, repeatability, and data analysis all but impossible. Staling occurs in two simultaneous ways over time: the loss of fresh flavors and the formation of "off" flavors. There is adequate evidence that oxygen is the primary enemy of roasted coffee, followed closely by temperature and moisture (Cappuccio and others 2001; Cardelli and Labuza 2001; Anese et al. 2006). Secondary staling factors include things that influence how coffee interacts with the external environment, including roast, coffee porosity, surface area/grind, light exposure, and water activity. For more about the science of coffee staling, see the SCAA Literature review on the shelf life of roasted coffee, available on the SCAA Digital Chronicle.

It is the mission of the Specialty Coffee Association of America (SCAA) to recognize, develop, and promote specialty coffee. Specialty coffee should always taste as delicious as possible. Maintaining the freshness of coffee is critical to preserving taste, especially as coffee is often sent home with customers. This fact led the SCAA to acknowledge a need for sensory testing within the coffee industry as with customers. This work was conducted as a joint effort between the SCAA and the Roasters Guild due to interest expressed by the membership. Together, the groups focused on answering some fundamental, taste-based questions. The industry has many assumptions about what happens to the taste of roasted coffee over time. A group of Roasters Guild-based project leaders set out to validate some of those assumptions and learn more about how production choices can influence the taste of coffee.

The research questions were:

1) Can we taste the staling of coffee, and if so, what is the rate of staling?
2) How does packaging type affect staling?
3) Do different coffees (grown in different regions, of different varieties, processed and distributed by different methods) stale differently?
4) Does resting time influence the rate of staling, as measured by taste?

Based on what is already known about the staling of coffee (see the SCAA Chronicle Literature Review on this topic) and the above research questions, four simple yet important hypotheses were formed:

1. The older the coffee, the more flavor is lost and tasters will like the coffee less.
2. Packaging type affects the staling rate of specialty coffee. Packaging with protection against oxygen, moisture, and heat will delay staling for longer than less protective packaging.
3. Different coffees (including variations in cultivar, origin, and processing method, among other factors) will lose flavor differently over time.
4. Coffee that is rested before packaging will have lower cupping scores and will afterward stale at the same rate as non-rested coffees, having lost many volatiles and flavor compounds during prolonged exposure to air.

Methods

Experiments took place between May and August 2012. Coffee was roasted and stored at Dillanos Coffee Roasters in Sumner, WA, and was overseen by the SCAA Coffee Science Manager. Cuppings to gather data from experienced cuppers and tastings for specialty coffee customers took place in the locations of many SCAA members and member companies within the United States and were self-administered with directions from the SCAA. Final experiments were conducted at the 2012 Roasters Guild Retreat, with the help of all specialty coffee professionals in attendance.

Treatment of Coffees. Three coffees were obtained by Dillanos Coffee Roasters for this project; one from Colombia, Rwanda, and Brazil. These coffees were chosen for their contrasting origins and cup profiles in order to highlight differences for the sub-experiment to investigate whether different coffees stale differently. The coffee from Colombia was chosen as the primary experimental coffee due to its characteristic washed, mild cup profile. It was utilized in the packaging-type and resting-time experiments. See Table 1 for more specific information about each coffee.

Table 1. Characteristics of Three Coffees Chosen for Staling Experiments

	Colombia	Brazil	Rwanda
Importer	Sustainable Harvest	Atlantic Specialty	Atlas Coffee
Farm/Location	Finca Potosi, Valle del Cauca, Caicedonia	Fazenda Sertao, Carmo de Minas	Abakundawa Coop, Musasa
Other Information	Organic and Rainforest Alliance certified; GrainPro bags	Blend of Bourbon, Icatu, Acaia cultivars; grown between 1200 and 1300 meters altitude	Bourbon cultivar; grown at 1900 meters altitude; Fair Trade certified
Process	Washed	Pulped Natural	Washed
Cupping Score at Import	83.25	84	86

For the majority of experiments, a quantity of each coffee was roasted weekly at Dillanos Coffee Roasters over a period of five weeks between May 17 and June 14, 2012 (schedule listed in Table 2). The Colombian coffee was roasted on two additional dates to provide freshly roasted coffee for testing at Roasters Guild Retreat (see Table 2 below).

Table 2. Roast Day Codes and Dates Roasted

Roast Day Code	Date Roasted
1	May 17, 2012
2	May 24, 2012
3	May 31, 2012
4	June 7, 2012
5	June 14, 2012
6*	July 17, 2012
7*	August 14, 2012

*Only Colombian coffee roasted on this date.

All coffees were roasted as closely as possible to the SCAA cupping roast-level standard (63 ± 1 unit, Agtron gourmet scale, ground) for the purpose of evaluation via cupping. Unifying roast level also allowed for exclusion of roast as any cause of flavor influence. The exact roast levels for roasts 1-5 are listed in Table 3. Roasts 6 and 7 of the Colombian coffee also attempted to replicate this end color. The most important consideration was to make sure coffees roasted on different dates were roasted to the same profile and color, allowing tasters to taste coffee flavor due to coffee staling versus roast across time. For example, the roast curves for the primary experimental coffee from Colombia are shown in Figure 1.

Table 3. Roast Levels (Agtron Gourmet Scale) for Each Experimental Coffee Over All Roast Days

Day	Colombia	Brazil	Rwanda
1	66.6	60	60.9
2	66	60.7	58.9
3	66.8	62.8	63.6
4	63.6	58.4	61.1
5	66.4	62.2	60.2
Average	65.8	60.82	60.94

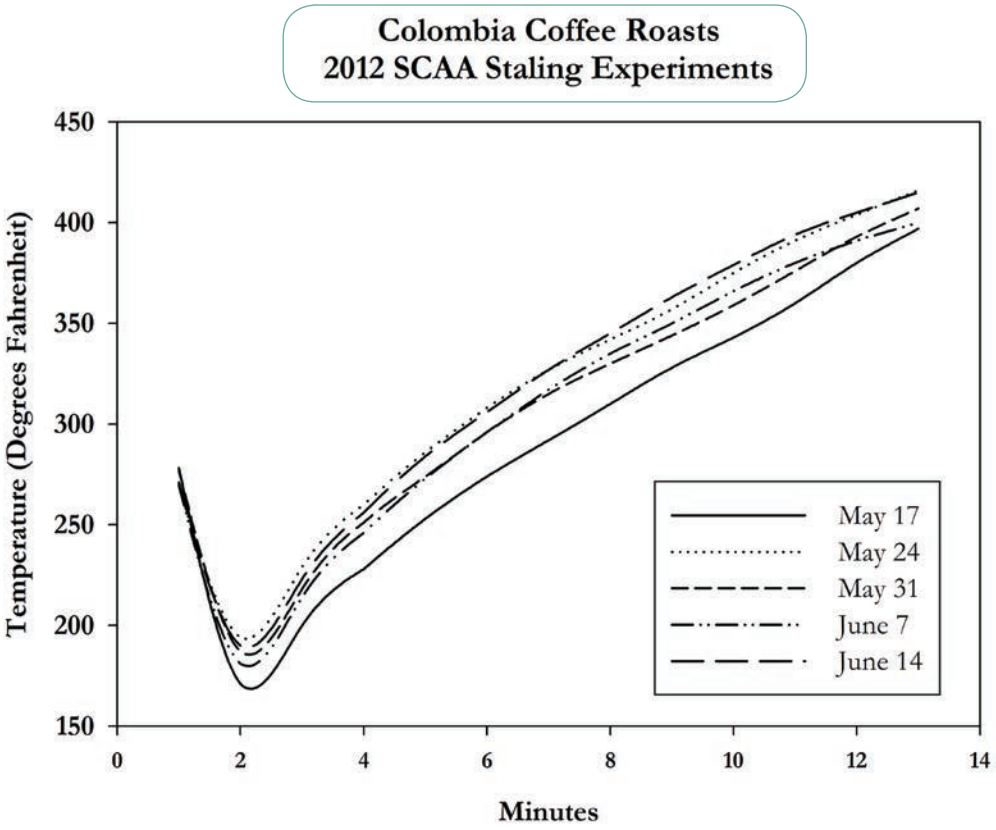

Figure 1. Roast curves [temperature in degrees Fahrenheit (°F) in roaster over time] for each roast of the primary experimental coffee from Colombia.

Experiments. For this member-driven initiative, one primary experiment and two sub-experiments were designed and conducted to test the hypotheses listed above. All of these experiments involved experienced cuppers, one was conducted with specialty coffee customers in SCAA-member retail locations, as well as with specialty coffee professionals at the 2012 Roasters Guild Retreat. The primary experiment involved all three groups of people and attempted to address research questions and hypotheses one and two, listed above, which have to do with the staling of roasted coffee in different packaging conditions. Research questions and hypotheses two and three were addressed as sub-experiments, as they were conducted on a smaller scale and served as supporting information to primary objective, specifically to investigate the effect of different coffees and resting-times on coffee staling. See further clarification of these experiments in Table 4 and narrative explanations in below paragraphs.

Table 4. Experimental Setup and Details

Experiment	Research Questions & Hypotheses Tested	Coffee Used	Participating Group	Number of Participants
Primary	1 & 2: Coffee Staling by Packaging Type	Colombia	Experienced Cuppers; Specialty Coffee Customers; and RG Retreat Participants	85; 103; and 77, respectively
Sub-Experiment #1	3: Different Coffees	Colombia, Rwanda, and Brazil	Experienced Cuppers	80
Sub-Experiment #2	4: Resting Times	Colombia	Experienced Cuppers	76

An experienced cupper was defined for purposes of these experiments as "one who cups three or more times per week and scores coffee based on the SCAA form." The SCAA recruited members to participate through newsletters, social media (Facebook and Twitter), individual outreach, and Roasters Guild emails. Members were asked to self-report whether they fit into the experienced cupper category and were trusted to only include colleagues that also fit into this category. Many members expressed interest in helping out, and in the end 85 experienced cuppers from over 60 SCAA member companies participated. For the experiment at Roasters Guild Retreat, 78 coffee professionals participated by completely filling out SCAA cupping forms. For customer experiments facilitated by SCAA member companies, over 100 specialty coffee customers participated at 15 different retail locations.

Storage and Distribution. After roasting and packaging, the coffees were all stored together until shipment to SCAA-member volunteer participants on June 15, 2012. In the case of coffees cupped at Roasters Guild Retreat, they were stored at Dillanos Coffee Roasters until ground transport to the event on August 17, 2012. Prior to shipment, all coffees were stored in a climate-controlled building in cabinets and boxes in a single room with no outside-facing windows. Coffee was distributed to member volunteers in order to distribute the sub-experiments among participants and were labeled with codes to prevent biased responses. Packages of coffee and instructions were shipped via ground or air depending on the distance from Washington State, to minimize shipping time (see Figure 2). Shipping was generously sponsored by Cablevey Conveyors.

Figure 2. Former Roasters Guild chair Phil Beattie assists with the packing and shipping of experimental coffees at Dillanos Coffee Roasters (June 15, 2012).

Cupping Methods. For all experiments involving experienced cuppers and coffee professionals, participants were instructed to follow the SCAA cupping protocol and to use the SCAA cupping form to evaluate the coffees presented to them. (The SCAA cupping protocol is detailed at length on the SCAA website and can be downloaded at www.scaa.org/?page=resources&d=cupping-protocols.) For each of these cuppings, each member group or company was provided with between six and twelve coffees, depending on the number of qualified cuppers available to participate and the specific experiment they would be participating in. They were asked to cup all the coffees at once (if possible) on a date of their choosing. They were also provided with SCAA cupping forms and asked to return those forms to the SCAA Coffee Science Manager on completion of their cupping. All cuppings by experienced cuppers that were included in the results of these experiments were concluded by July 10, 2012. The oldest coffees cupped for these experiments were 55 days from roast (henceforth referred to as *days after roast*). The cupping experiment held at Roasters Guild Retreat was conducted on August 17, 2012; for which the oldest coffee was 93 days after roast.

For the packaging-type experiment (described below), specialty coffee customers participated. The SCAA recruited individual members who work within retail coffee shops as well as retail members who administer regular public cuppings to lead the customer preference experiments. General instructions for conducting the customer taste preference experiment were sent, including using a modified cupping protocol in order to present a uniform cup to customers. Volunteers were asked to use SCAA standards for ratio of coffee to water, cup size, spoon size, water quality and temperature, crust-breaking time, and time between grinding and cupping. Otherwise, volunteers were allowed to utilize their normal public cupping space and methods for this test.

Primary Experiment: Coffee Staling by Packaging Type. For this experiment, three common methods of packaging were chosen to represent the majority of packaging categories utilized by Roasters Guild members: a natural kraft paper bag; a foil bag with a one-way valve; and a foil bag with a one-way valve, flushed with nitrogen gas. The kraft bags were of one-pound size, with a tin-tie closure and a polypropylene liner. This liner is produced by the manufacturer to keep coffee oils from wicking onto the paper outer and is not an effective barrier to oxygen. Kraft bags are described by the manufacturer as "designed for products that do not require long shelf life." The foil bags were also a one-pound size. The bags have three-ply polyester and aluminum lamination, providing an oxygen and moisture barrier. These bags are gusseted with a one-way valve. Nitrogen-flushed foil bags were the same composition as the one-pound foil bags, but were a five-pound size. This size difference did not change any potential comparison as nitrogen flushing removed almost all oxygen within them. Each bag type was coded with a number and letter descriptive of the specific treatment of coffee inside. This code was unrecognizable to cupping leaders. Coffees in kraft and foil bags were sent to 30 locations for customer cuppings and over 100 customer rankings were returned to the SCAA for analysis. After the return of all experienced cupper scoring forms there were at least 124 individual cupping results for the foil and kraft bag types. The number scores returned for coffee packaged foil N flushed bags was lower than expected and therefore was focused on during the Roasters Guild Retreat event. All three packaging types were also used during the Roasters Guild Retreat coffee professionals cupping.

Customers were given two groups of three coffees of various ages, bagged in both foil and kraft packaging types, and asked to rank them in order of preference. They were also able to add tasting notes. They were not instructed to rank a particular attribute, but to simply rank the coffees in order of their own personal preference. The two groups of coffees were presented to them in random arrangements so that rankings could be converted to a scale of six. These rankings were then averaged by bag type and days after roast to help understand customer preference between packaging types over time. Although this method was very simple it was deemed adequate for the scope of this study, which was essentially pilot-level for consumers and will likely be expanded upon in subsequent SCAA experiments.

Sub-Experiment #1: Different Coffees. For this sub-experiment, experienced cuppers scored three different coffees (from Colombia, Brazil, and Rwanda) of differing ages in one packaging type (foil bag), bagged immediately after cooling (no resting time). These coffees were distributed to participants in order to facilitate an even number of the different coffees tasted/sample size, as no one cupper could cup the full set of experimental coffees (five roast days x three coffees = 15 coffees). Coffees for this experiment were sent to 20 member locations for group cuppings. They were tasted by experienced cuppers using the SCAA cupping protocol and cupping form, which was returned to the SCAA for analysis. A minimum of 79 individual cupping scores were collected for each of the three coffees packaged in the foil bag after no resting time.

Sub-Experiment #2: Resting-Time. Four different resting times (including a control of no resting time) were chosen to reflect typical roasting practices. Resting times tested were: 0 hours (after cooling to room temperature), 12 hours after roast, 24 hours after roast, and 48 hours after roast. The Colombian coffee was rested in buckets open to the air in the roastery to simulate typical small roaster practices. Experienced cuppers evaluated rested coffee of different ages. Again, no one cupper was able to evaluate the full set of coffees (five roast days X four resting times = 20 coffees), therefore partial sets were distributed randomly to cuppers in order to facilitate even sample sizes among treatments. Coffee from this experiment was sent to 20 locations. At least 75 individual cupping forms were collected from each of the four resting-time treatments.

Data Analysis and Statistics. Data were compiled and analyzed by the SCAA Coffee Science Manager. Coffee roast levels were tested for differences with an analysis of variance (ANOVA) test. Each cupper was assigned a number to track all coffees that they cupped. For the purposes of this experiment, only "total coffee score" on the SCAA cupping form was used to evaluate coffees. Descriptive statistics were run on experienced cupper scores and customer rankings based on days after roast and packaging type.

Cupping dates were grouped by week to evenly distribute results by days after roast. Both experienced cupper scores and customer rankings were tested for differences using an ANOVA test by weeks after roast and packaging type. Differences in experienced cupper scores (also grouped by week) on coffee type and resting times were tested for significance with ANOVA tests.

To investigate staling rates, a regression analysis was run on experienced cupper scores, as well as for the Roasters Guild Retreat cupping with coffee professionals, over the range of days after roast. The slopes of those regressions were tested for differences using analysis of covariance (ANCOVA) tests. These tests were run to determine if staling rates were statistically the same or different between the three different coffees, the three packaging types, and the four resting times.

Results and Discussion

Roast Levels. An ANOVA test showed that the coffee from Colombia was roasted significantly darker than the Rwandan and the Brazilian coffees (p=<0.001). The Rwandan and Brazilian coffees were not significantly different from each other (p=0.96). Since many factors differed between these coffees (such as country of origin, variety, processing type, etc.) we were confident that the roast of the Colombian coffee was not likely to be primarily responsible for differences in coffee scores. To be sure, after these three coffees were cupped, a regression analysis was run and we found that roast level did not explain the scores given to the coffees (R^2=0.002). The results of this can be seen in Figure 3, which shows the regression line fit to scores of the coffees based on their Agtron color. Therefore, despite the fact that the roast of the Colombian coffee was slightly different, the results showed that this did not influence the score of the coffees. From this, it can be speculated that other factors were responsible for scores given to coffees of varying ages.

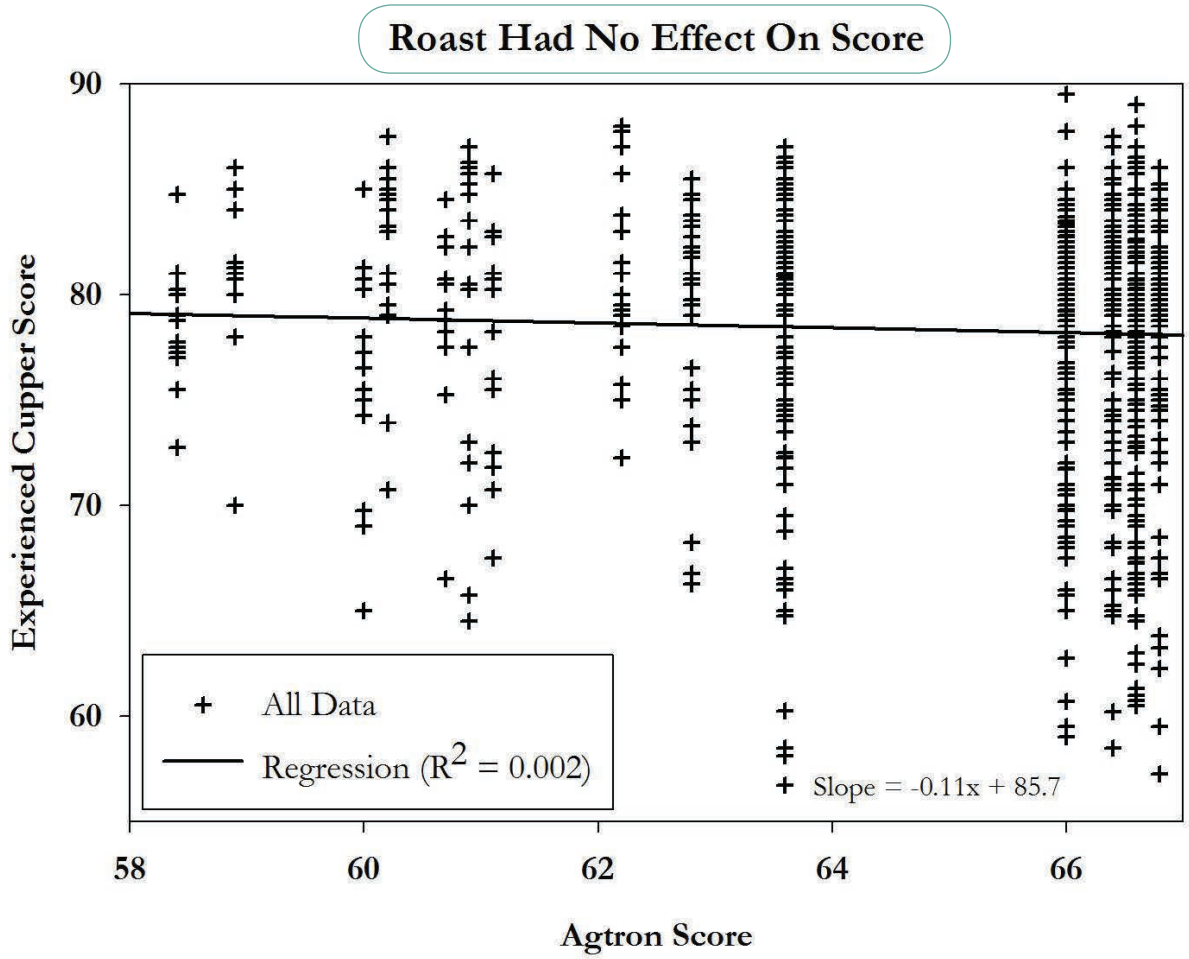

Figure 3. Regression analysis on total cupping scores by roast level (Agtron score). Regression analysis indicated that the roast level of coffees had no effect on score (R^2=0.002).

Primary Experiment: Coffee Staling by Packaging Type. Experienced cuppers scored Colombian coffee of a variety of ages (days after roast) packed in three different bag types to estimate the effect of staling over time. However, due to a small number of scores returned on coffee packaged in foil N flushed bags, this data was excluded from experienced cuppers (see Figure 5). When looking at days after roast, there was large variance in coffee scores. Regression analyses were run on both packaging types and were not robust (R^2=0.06 and R^2=0.01 for kraft and foil bags, respectively). Despite the variation seen in cupping scores, the slopes of these regressions were different from one another, indicating that the staling rates for these bag types were likely different. The ANCOVA statistical test confirmed that the packaging types likely resulted in different rates of staling, with coffee in kraft paper bags staling faster than coffee in foil valve bags (p=0.04). This trend was nicely demonstrated when cupping scores were averaged (see Figure 6). Slopes representing the decline of cupping scores over time are clearly steeper, indicating faster loss of flavor for kraft paper bags relative to foil valve bags. Staling rates were not calculated in rise-over-run (loss of score over time), as these rates were not expected to be exact (as evidenced by regression analyses) or applicable to all coffees (as evidenced by results of the coffee sub-experiment). However, the results indicating different staling rates were encouraging and warrant further research on this topic.

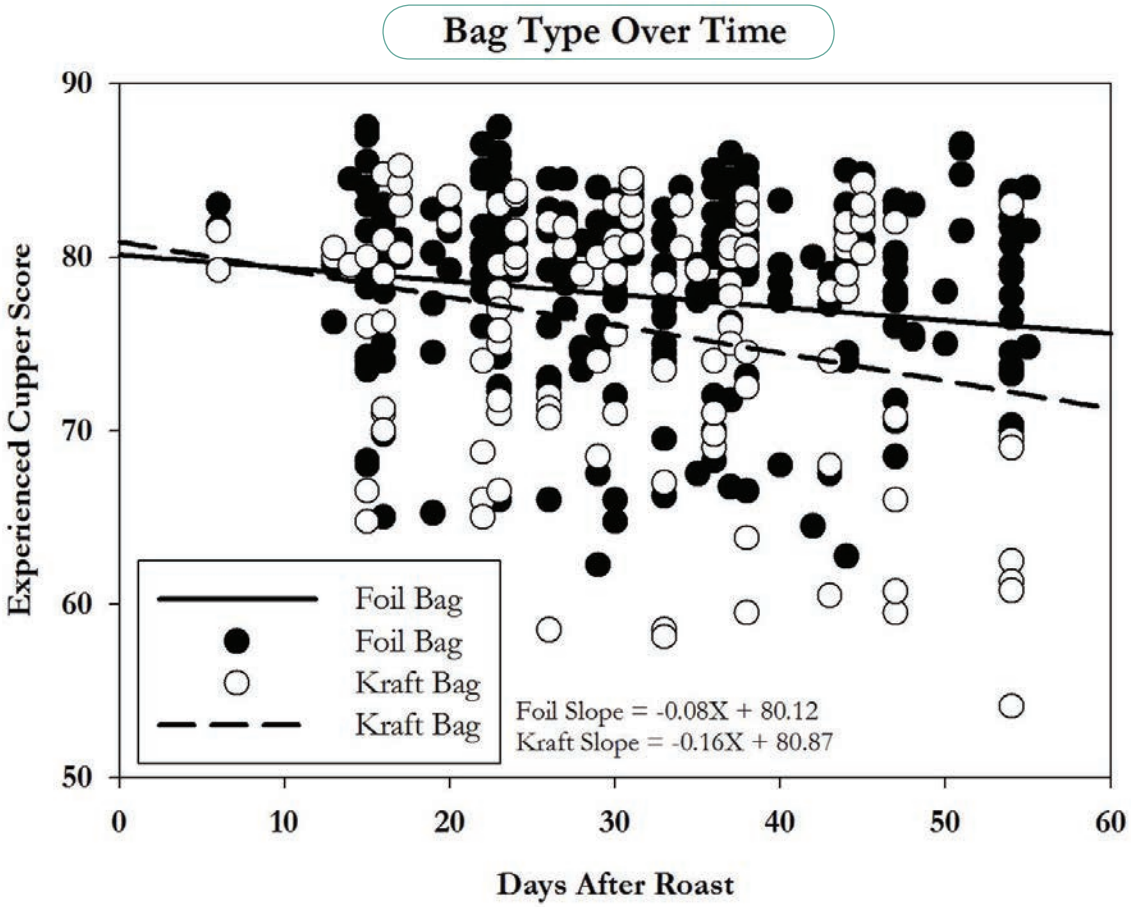

Figure 5. Experienced cupper scores of Colombian coffee by various days after roast. These coffees were packaged in either foil valve (filled dots) or kraft paper (open dots) bags.

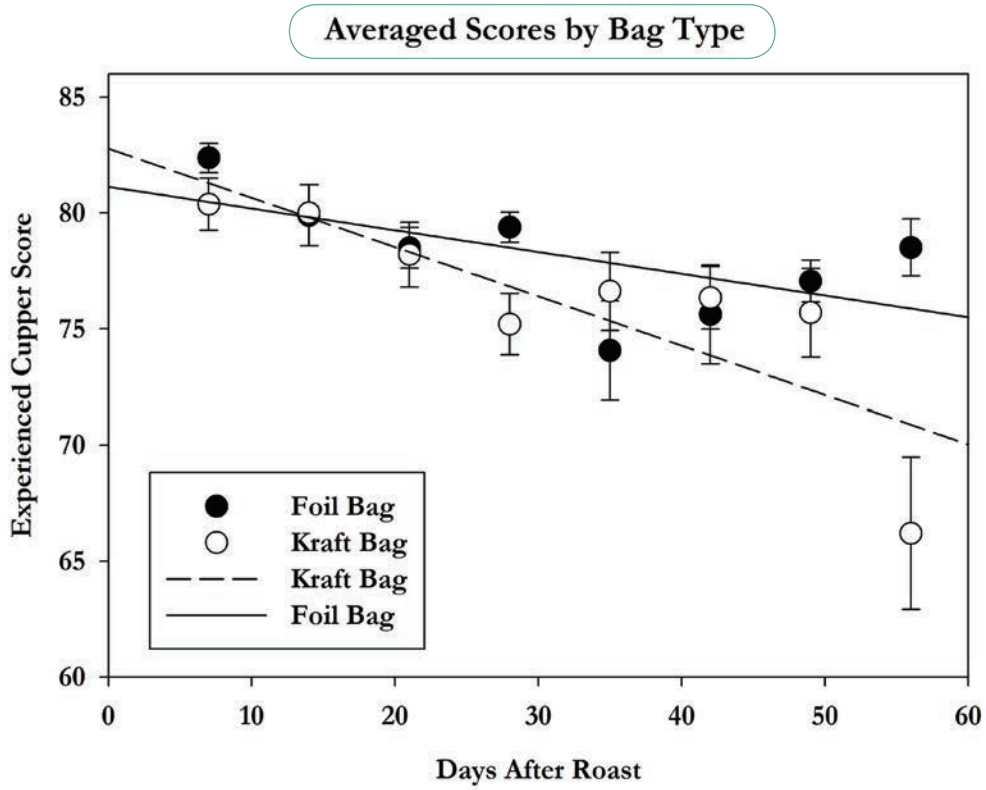

Figure 6. Averaged scores of experienced cuppers for the Colombian coffee, bagged immediately after cooling in either the foil (filled dots) or kraft (open dots) bags, with standard errors. Lines demonstrate the differing slopes, representing the decline of coffee scores over time (i.e., staling rates).

During the 2012 Roasters Guild Retreat, specialty coffee professionals cupped and scored the Colombian coffee packaged in all three bag types: kraft paper bags, foil-valve bags, and foil-valve bags that had been nitrogen flushed. This group of professionals had mixed personal backgrounds and did not necessarily fit into our experienced cupper category, therefore these results are considered separately in Figure 7. When tasting fresh coffee (four days after roast), bag type did not make a difference in the group's scores (ANOVA; p=0.84). However, as the coffee aged the group trended to score coffee stored in foil bags higher than coffee stored in kraft paper bags. At 93 days after roast, tasters scored coffee packaged with nitrogen flushing and foil bags the highest, with an average score of 77.9 points. Coffee stored in kraft paper bags scored on average 76.3 points after 93 days. However, the variation in cupping scores prevented this difference from being statistically significant (ANOVA; p=0.32) and the regressions run on the slopes indicated that staling rates were not statistically different (ANCOVA; p=0.655).

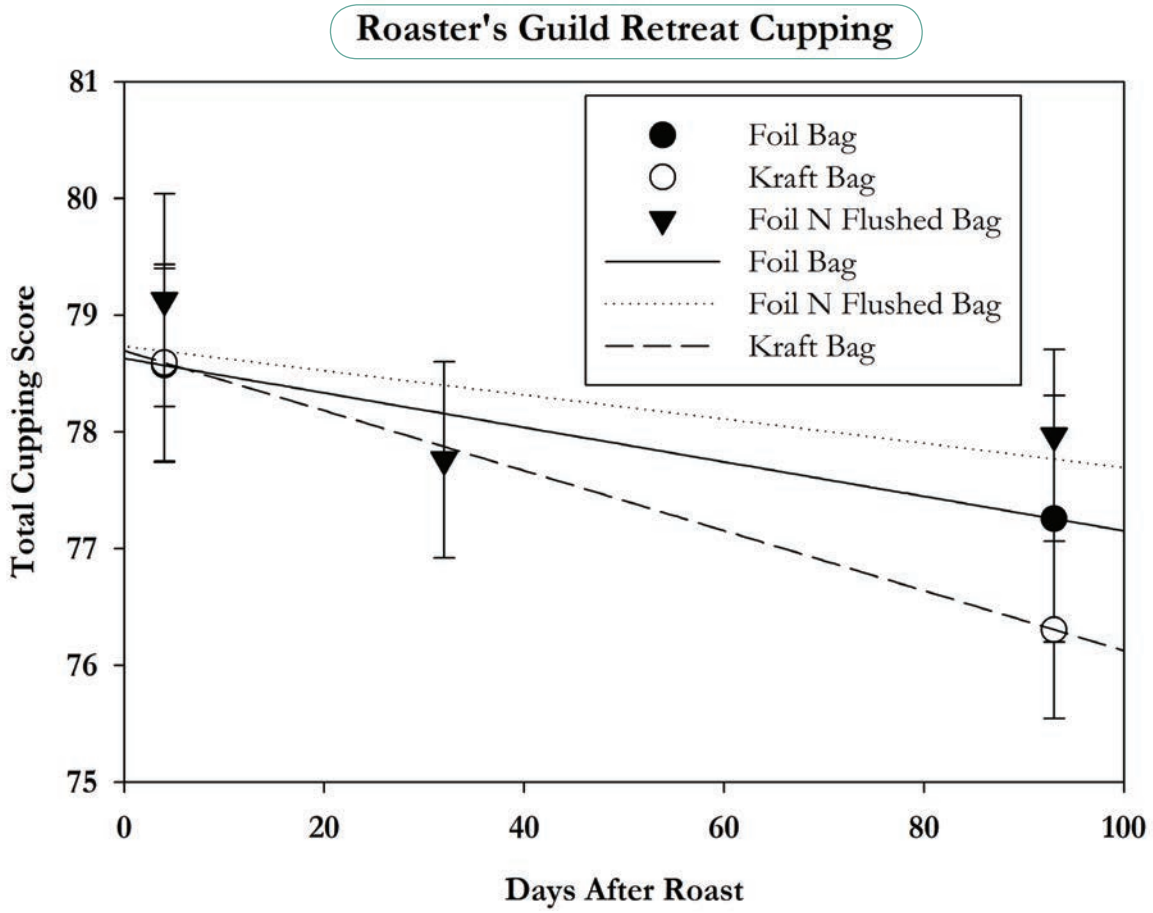

Figure 7. Averaged scores from specialty coffee professionals of the Colombian coffee, bagged immediately after cooling in either foil (filled dots), kraft (open dots), or nitrogen-flushed (filled triangles) bags, with standard errors. Lines demonstrate the differing slopes, representing the decline of coffee scores over time (i.e., staling rates).

Specialty coffee customers ranked the Colombian coffee of different ages and packaging types, based on overall preference. When all rankings were examined, customers did not show preference based on time after roast. This indicates that perhaps as a group they were unable to differentiate between freshly roasted versus older coffees (see Figure 8). Regression statistics were run relating days after roast to ranking and these were not significant (Both R^2s <0.001). Also, the slopes of these regressions were not different than each other (ANCOVA test, p=0.39). However, customers trended toward preferring coffees packaged in foil bags and this was most apparent when rankings were averaged (see Figure 8). This trend was found to be statistically significant when coffee age was not considered (ANOVA test, p=0.04; see Figure 9).

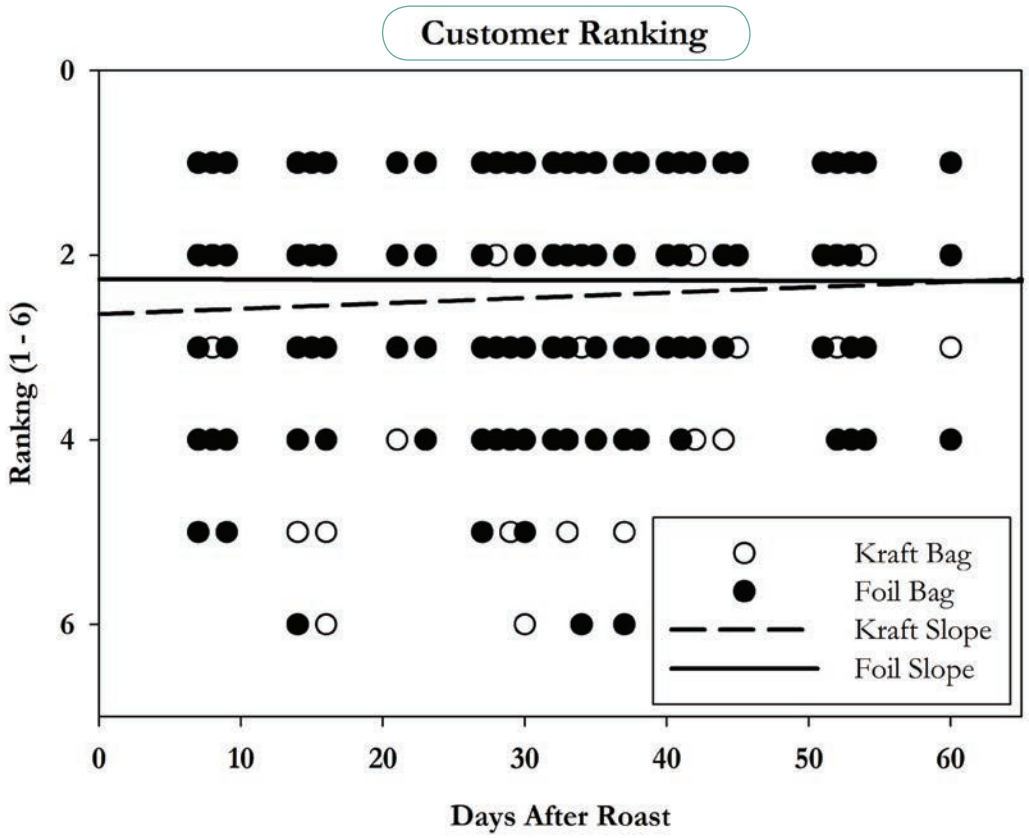

Figure 8. Specialty coffee customer ranking (scale of 1-6, where 1 is most preferred) of Colombian coffee of different ages (days after roast) packaged in either kraft paper (open dots) or foil valve (filled dots) bags. Regression slopes are shown overlaying the data. Regressions for coffee in kraft bags (dashed line) and foil bags (solid line) were not significant (R^2<0.001) and slopes were not significantly different than each other (p=0.39).

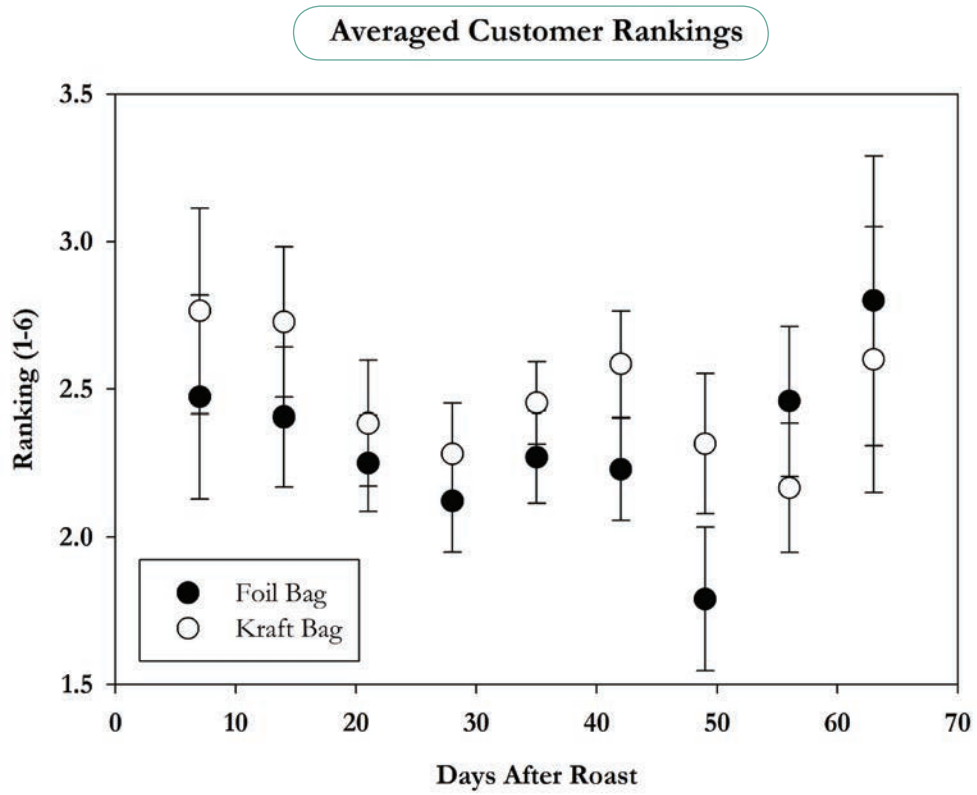

Figure 9. Averaged customer ranking (scale of 1-6, where 1 is most preferred) demonstrating that customers prefer coffee in foil bags (filled circles) more than kraft bags (open circles). This trend was statistically significant when data from all days after roast were grouped (p=0.04).

Sub-Experiment #1: Different Coffees. For this sub-experiment, experienced cuppers scored three different coffees from Colombia, Brazil, and Rwanda. There was large variance in coffee scores. Regression analyses were run on each coffee to determine to what extent the variation in scores could be attributed to coffee type. Although the regressions were not robust (see Figure 4), the slopes of these regressions were distinctly different from each other, indicating that the staling rates of these coffees were likely distinct. The ANCOVA statistical analysis confirmed that some but not all of the coffees had different staling rates. The staling rate of coffee from Rwanda was not statistically different than either the coffee from Brazil (p=0.39) or Colombia (p=0.28). However, the Brazilian and Colombian coffees had significantly different staling rates from one another (p=0.02; see Figure 4 regression slopes).

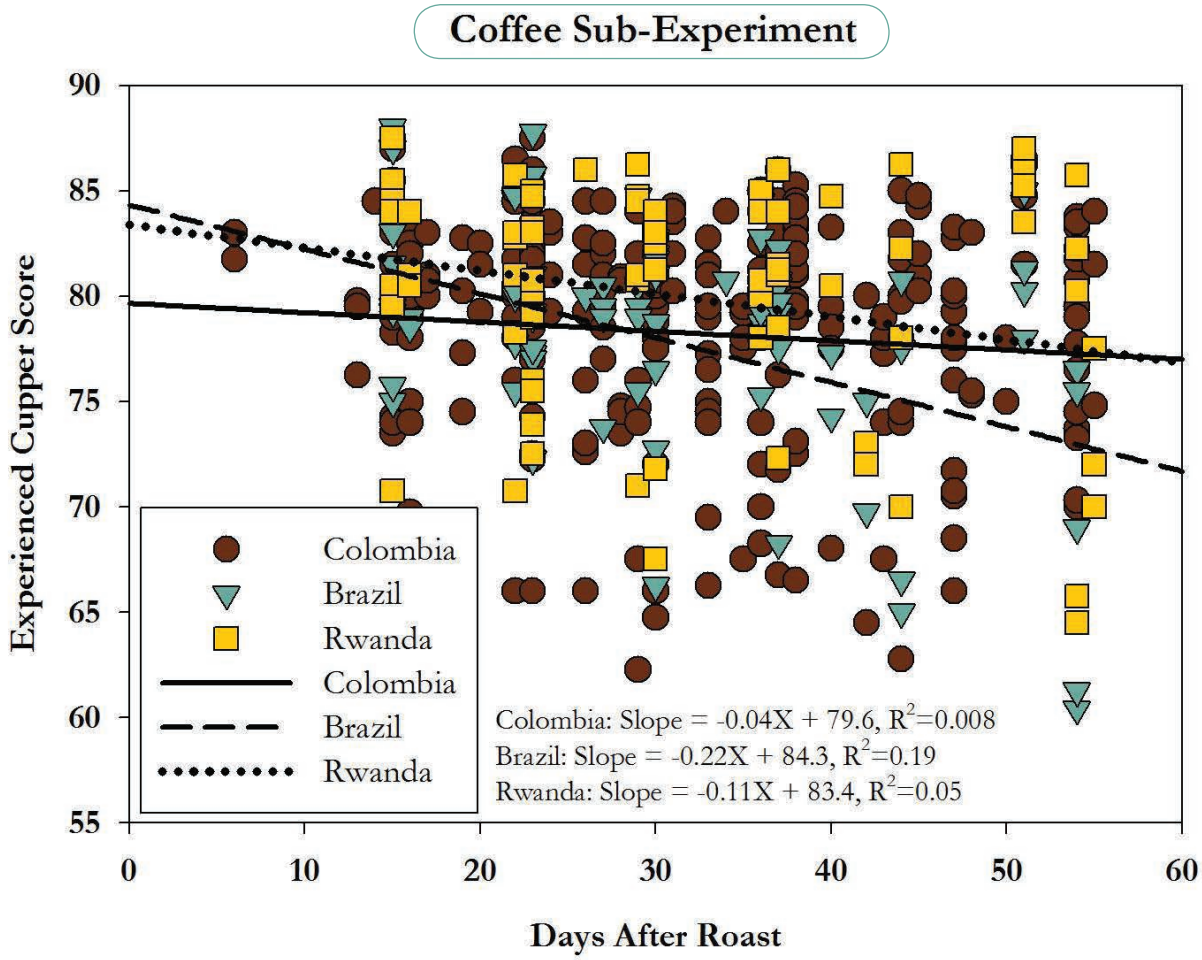

Figure 4. The individual scores of coffees from Colombia (brown circles), Brazil (blue triangles), and Rwanda (yellow squares) as they aged (days after roast), as measured by experienced cuppers. Regression analysis results for coffees from Colombia (solid line), Brazil (dashed line), and Rwanda (dotted line) are plotted on top of individual results for each coffee.

It is the assumption of much of the coffee industry that different coffees stale at different rates due to their unique chemical and physical properties. As this had not been tested within the specialty coffee community, it was a necessary research question for this group to address. The hypothesis that different coffees would stale differently was found to be true in some but not all cases. Different coffees did stale at different rates in this particular bag type (foil). It is important to note that there was no attempt to break out all of the possible mechanisms contributing to these differences. At this juncture, we cannot speculate about the specific reasons that these particular coffees had different staling rates. However, in subsequent experiments it will be important to remember that coffees of different varieties, from different origins, or differently processed are likely have a suite of chemical differences that not only influences the way they taste, but also how they age and stale.

Sub-Experiment #2: Resting-Time. Experienced cuppers scored coffees that were rested for different amounts of time before being packaged in foil bags. As with the other experiments, there was much variation in coffee scores at each day after roast. Regression statistics were run on coffee scores for days after roast and were not significant. However, the slopes of these regressions differed a great amount from each other, with coffees that had no resting time showing the slowest decline in score over time as compared with rested coffees (see Figure 10). The staling rates (loss of cupping score over time) of all coffees rested before being packaged were found to be statistically the same (ANCOVA, p=0.96) regardless of whether the coffee was rested for a short or long time. However, coffee that was immediately packaged after cooling had a different slope (ANCOVA, p=0.04) that was less steep than the slope for rested coffees. This indicates that non-rested coffee lost flavor (indicated by cupping score) at a slower rate than coffee rested before packaging, perhaps because fewer volatile compounds were lost before the coffee was protected.

There was one unexpected finding of this experiment, which became apparent once the data were graphed. In Figure 10, data appear to suggest that allowing coffee to rest may positively affect cupping scores during the first two weeks or so after roasting. However, at this time there is only marginal evidence to suggest such a phenomenon; not enough data points were collected during the two-week period immediately after roasting. There is some possibility that this phenomenon could be real, in which case further study is warranted. A possible explanation is that a slight amount of degassing could be good for flavor. However, this remains an open question and mechanisms to explain the observation would have to be investigated in a dedicated future study.

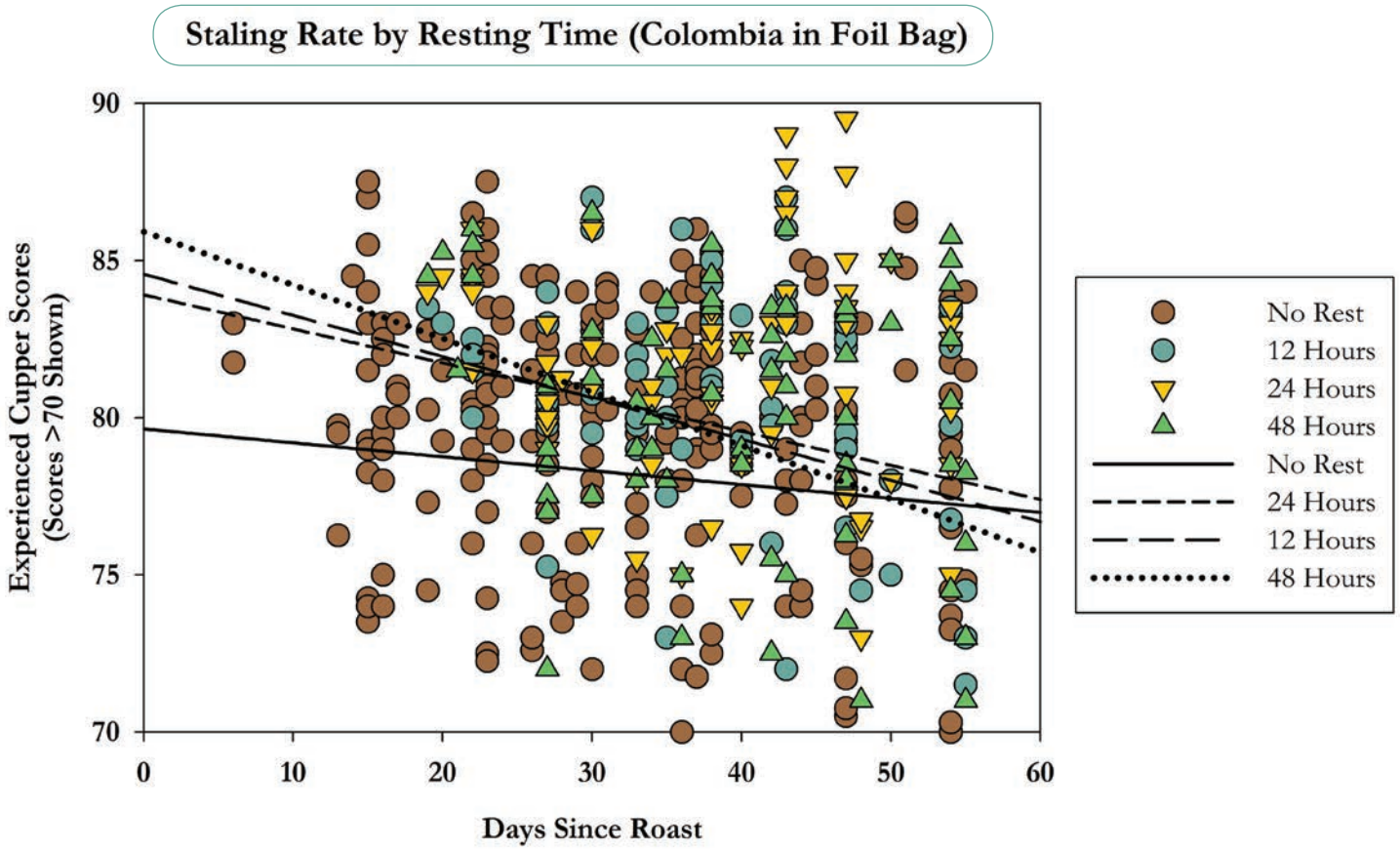

Figure 10. Experienced cupper scores and regressions for the Colombian coffee packaged in foil bags immediately after cooling (i.e., no rest; brown circles, solid line) or rested in open buckets for 12 (blue circles, medium dashed line), 24 (yellow triangles, large dashed line), or 48 hours (green triangles, dotted line).

Caveats and Conclusions

There are important limitations to the results presented above. Perhaps the most important is that although this research demonstrates that different coffees stale differently, there has been no full investigation of the mechanisms behind this. All other experiments proceeded with only one coffee (from Colombia). Ultimately, these results can be used as a good starting point and good evidence, but based on our results are likely not universally applicable to all coffees. Another constraint on the results is the variation in cupping scores. Despite the fact that we were able to show staling rates by decline in cupping scores over time, the variation in scores often prevented results from being statistically significant.

In the end, this report cannot tell you how long your coffee will remain fresh, or what your company's shelf life should be. Instead, these results can serve three important purposes. First, the results validate commonly held assumptions about coffee packaging. We found statistically significant evidence that more protective bags preserve the taste of coffee for longer than less protective bags. Second, we validated that different green coffees stale differently after roasting. Third, despite the variation in cupping scores this research validated that experiments using large numbers of experienced coffee cuppers can show real trends and patterns. We are pleased to report that the SCAA cupping form can be of use in such studies with an adequate sample size of highly experienced individuals. Based on this information as well as individual quality control initiatives, the SCAA encourages companies to determine their own best practices to preserve coffee freshness based on internal standards and this SCAA original research.

Thank you to our partners.

DILLANOS
COFFEE ROASTERS

REFERENCES

Anese M, Manzocco L & Nicoli MC. 2006. Modeling the Secondary Shelf Life of Ground Roasted Coffee. Journal of Agricultural and Food Chemistry 54(15):5571-5576.

Cappuccio R, Full G, Lonzarich V & Savonitti O. 2001. Staling of Roasted and Ground Coffee at Different Temperatures: Combining Sensory and GC Analysis. Proc. 19th ASIC. Trieste.

Cardelli C & Labuza TP. 2001. Application of Weibull Hazard Analysis to the Determination of the Shelf Life of Roasted and Ground Coffee. LWT - Food Science and Technology 34(5):273-278.

Illy A & Viani R. 2005. Espresso Coffee: The Science of Qualtiy, 2nd ed. San Diego: Elsvier Academic Press.

Nicoli M, Calligaris S & Manzocco L. 2009. Shelf-Life Testing of Coffee and Related Products: Uncertainties, Pitfalls, and Perspectives. Food Engineering Reviews 1(2):159-168.

Nicoli MC, Innocente N, Pittia P & Lerici CR. 1993. Staling of Roasted Coffee: Volatile Release and Oxidation Reactions During Storage. Proc. 15th ASIC. Montpellier.