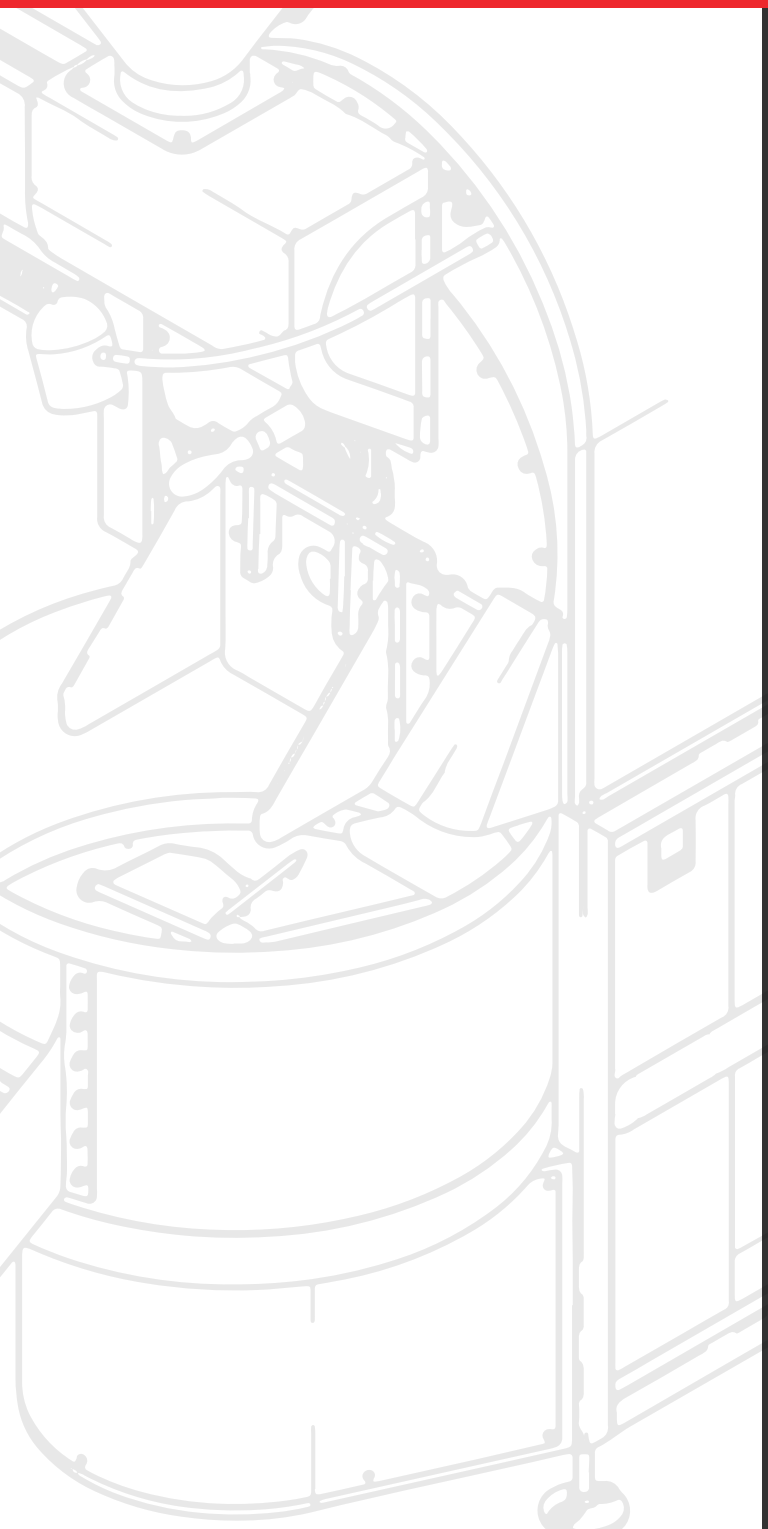
LORING®

The Smarter Way to Roast



How to Avoid Roasting Defects

TECHNICAL PAPER

OVERVIEW

Roasting defects are a fact of life for anyone responsible for roasting coffee. The key to avoiding them is to understand the different types of roasting defects and what causes them in the first place. Your roasting style, and even your equipment, can make all the difference.

ROASTING DEFECTS DEFINED

Roasting defects are flaws in roasted coffee that are caused by the amount of energy being applied during each phase of the roasting process as well as the types of heat application that are being favored. These defects can be categorized as either subjective or objective roasting defects. Subjective indicates it is at least somewhat dependent on the point of view (or taste) of the observer. Those categorized as objective are measurable and not often up for debate. We will review both types of roasting defects, including some of the most commonly encountered: scorching, facing, tipping, baking, over-developed, and under-developed.

ROASTING DEFECTS DEFINED

KEY TERMS

In this section on Subjective Roasting Defects, we will be focusing on the below terms:

- UNDER-DEVELOPMENT
- OVER-DEVELOPMENT
- ROASTY
- BAKED

Subjective Roasting Defects

These are defects that are often pointed to by roasters and professional coffee tasters as being undesirable flavor notes in the coffee. They are purportedly caused by some sort of incorrect choice on the part of the roaster operator leading to a "bad" roast profile. These defects are considered subjective because, in many ways, beauty is in the eye of the beholder. When it comes to coffee, if the person roasting it, and the people consuming it consider the coffee to be good, is it a defect? Due at least in part, to the taste or opinion based nature of these defects, there are not clear definitions of what causes them, or even consistent nomenclature.

In the following section I will endeavor to describe these defects and point to the commonly identified cause. It is important for us to note that, because these are caused by the operator, they can be created to an extent on any piece of roasting equipment on the market.

Also note that the subjective roasting defects may be exacerbated or diminished by factors external to roasting. A coffee roasting professional will be roasting to suit the water that they are using to brew, taste, and perform quality control on the coffee. A thoughtful operator will roast with the composition of the water and brewing ratios that we have in our cupping labs in mind. Because of the variability of how coffee extracts, what is properly developed for our water mineral content or brewing ratio and composition may not be properly developed for another's. For example, coffees roasted in areas with higher water minerality in mind tend to taste under-developed when brewed with low mineral content water. This, in addition to flavor preference add a new layer of nuance to the discussion of under/over-development and under/over-roasting. We commonly see this disagreement come up due to personal taste differences, cultural differences, or even generational differences.

Subjective Roasting Defects

UNDER-DEVELOPMENT

Classically, this roasting issue is characterized by a malty/nutty character, aggressive acidity, metallic, and vegetative characteristics. This is subjective for two reasons:

1. *There is a segment of the population and roasting community that finds an aggressive acidity to be very positive*

2. *It is dependent on the water you are using to brew / taste the coffee as well as the coffee to water ratio you are using.*

For those sensitive to acidity or opposed to an excessive acidity in a coffee, a coffee may be described as under-developed; however that same coffee could be rated as properly developed or over-developed by another taster.

Classically, under-development has been talked about as being a result of either too short of a "development-time" (the time from the beginning of first crack until the end of the roast) or too low of an end temperature. It is however beneficial to separate the two as they have separate causes. Under roasted would address a final temperature that is too low, and under developed would point toward a time after the beginning of first crack that is to short. Additionally, whenever anyone says "under-developed or under-roasted" it should be understood as "for their preferences."

OVER-DEVELOPMENT

On the other side of the coin is what is considered "over-developed" coffees. These are coffees which are frequently characterized by low or muted acidity, a heaviness, and lack of nuance or depth. As with under-development this is all subjective and depends on the person.

This tends to come from too much time between the beginning of first crack and the end of the roast. Additionally, I think it is important to distinguish between over-developed and over-roasted. For the sake of defining terms: over-development meaning too much elapsed time after the beginning of first crack, and over-roasted meaning too high of a finish temperature.

Subjective Roasting Defects

ROASTY

This is possibly the most vague assessment made with regards to roasting defects. Simply put, this is often an indication that the person making the comment did not like your coffee.

On a serious note, this is more often than not attributed to over-roasted. It means that the issuer of the comment believes that the coffee would have been better with a lower end temperature.

BAKED

This one is one of the more hotly debated defects in roasting, as there are various definitions of what "baked" coffee is and how it occurs. Many would describe it as dull and lifeless, bready, malty, etc.

Some describe this defect as coming from too sharp a drop in RoR (Rate of Rise, the change in Temperature per unit of time =ΔT/Δt) after the first crack, or a large dip in the RoR after the first crack followed by a rise. Others identify it as stemming from a loss of bean temperature during sugar caramelization, and though the roast goes on to finish, the typical byproducts cannot be properly generated. Still others define it as a long development time (like 4+ mins) with a flat RoR. Essentially, there is not consensus on this point in the coffee roasting community.

Similar to roasty, the only thing one can be sure of is that the person using the term found your coffee to be displeasing.

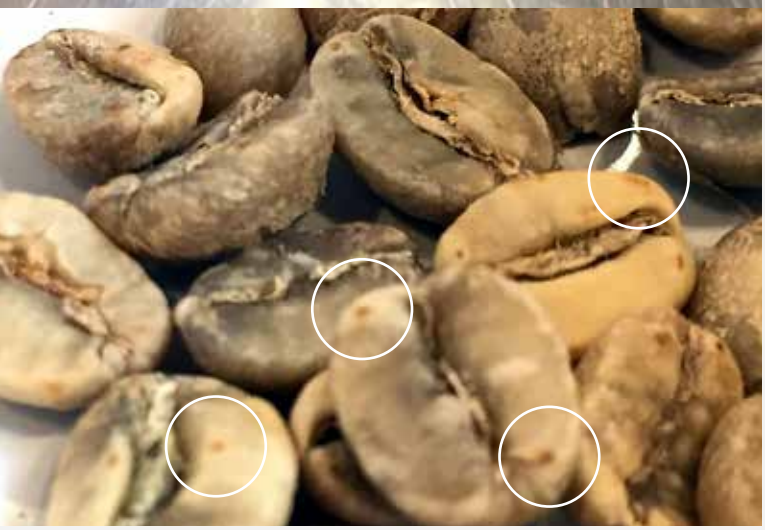
Objective Roasting Defects

Objective roasting defects, on the other hand, are marked by obvious, and measurable markers. While they do cause flavor taints in the coffee, these off-flavors are not the sole means of identification.

KEY TERMS

In this section on Objective Roasting Defects, we will be focusing on the below terms:

- SCORCHING
- FACING
- CHIPPING
- TIPPING



SCORCHING

The defect commonly referred to as scorching is a defect where small brownish black or black specks appear on the outside surface of the bean. This commonly happens before the bean begins to turn brown. Scorching on the surface of the bean toward the end of roasting goes by a different name, facing.

Scorching's root cause is that the metal in which the coffee bean is in contact during roasting is too hot, and wherever the coffee comes in-contact with that metal it causes a surface scorch on the bean. This can be caused by: charging too hot, charging with too low of airflow, or applying too much burner early in the roast (specifically when roasting on a thinner drum).

FACING

Similar to scorching, Facing is caused by hot metal coming into contact with coffee and generating surface damage. However, facing tends to come from either the beans being forced against the inner surfaces of the drum wall late in the roast once the volume of the batch has increased or due to overheating the metal of the drum toward the end of the roast.

CHIPPING

The defect known as chipping is classified by a small, round or oblong crater which has been blown out of the bean during roasting. This defect tends to only occur in darker roasted coffees, specifically those roasted to or past the beginning of second crack.

There is, to my knowledge, no clear and researched reason for the occurrence of chipping. Many have suggested that pressure built up or trapped within the bean could cause the blowout to occur once the bean becomes brittle due to dark roasting. Others have cited uneven moisture content in the bean originally. Luckily this defect does not seem to have any perceived impact on flavor.

TIPPING

Tipping primarily comes from roasting the coffee too rapidly. On the coffee bean, the point at which the embryo would have germinated is weaker than other parts of the bean. Because of how heat impacts the coffee unevenly (due to the shape and varying thickness of the seed) this soft spot can roast ahead of the rest of the bean or burn while the rest of the bean is progressing normally. Each seed has the potential for this issue, and the durability of this point seems to be connected with the overall density and growth altitude of the coffee. This charred spot on the bean will frequently occur at the beginning of the roast (before brown) but can sometimes occur late roast as well. Late occurrences are infrequent.

COMMON CAUSES OF ROAST DEFECTS

COMMON CAUSES

There are three major areas where roast defects tend to come from:

- ROASTING TOO QUICKLY
- ROASTING TOO SLOWLY
- UNWANTED THERMAL CONDUCTIVITY

Roasting Too Quickly

When thermal energy is transmitted to the coffee too quickly it can bring up a number of objective and subjective roasting defects. With regards to the objective defects, too much heat can cause tipping, and when the heat is over-applied through the metal surfaces we see scorching and facing. Subjectively, applying too much heat energy can push the roast along too quickly and cause “under-development” if not properly controlled post first crack.

Roasting Too Slowly

When roasting too slowly, objective roasting defects are not really a concern, however subjective roasting defects can be a real issue. Roasting too slowly, particularly at the end of the roast can cause over-development. If the heat energy is slowed too dramatically, then baking can also be an issue.

Unwanted Thermal Conductivity

Unwanted thermal conductivity, such as over-heated metal can cause scorching and facing depending on when in the roast the coffee beans are exposed to the hot metal. Additionally, it could be blamed for chipping as well. This is particularly speaking to some form of uneven heat energy distribution within the coffee bean that causes the chip to be blown off the bean at darker roast levels.

HOW LORING ROASTERS HELP AVOID DEFECTS

Loring roasters allow operators to avoid a number of roasting defects due to a system design that makes it unique compared to the majority of traditional drum roasters.

Convection Heating

First of all, the objective roasting defects of scorching and facing tend to rely on the drum being directly heated by the power source. If there is no direct heat on the drum materials, then it is difficult if not impossible to overheat the metal which comes in contact with the beans to the point of causing these defects.

Loring roaster design relies primarily on convection heat. This means that the primary method of roasting the beans comes through hot air, rather than contact with the metal drum surface. Coupling this with the high airflow, appropriate temperature faults, and temperature maximums the Loring (unless pushed outside of operating tolerances through fake roasting or settings changes) is not capable of producing these defects.

Thorough Drum Agitation

In addition to avoiding these defects by keeping direct heat off the drum walls themselves, Loring roasters also insure that the drum paddles are mixing and lofting the coffee as much as possible. This means that the machine is, through paddle design and rotation speed, ensuring that the beans are being evenly heated and appropriately moved throughout the drum. Scorching, and facing are, once again, avoided.

Proper Drum Sizing

Finally, through proper drum sizing, the Loring machines prevent coffee from getting stuck against the side walls of the machine due to volume expansion from roasting. The Loring product line is at most 25% full relative to the volume of the drum when loaded with a full capacity batch. This means that were the beans to swell to their theoretical maximum (100%) the drum would still only be half full.

AVOIDING SUBJECTIVE ROAST DEFECTS

In addition to preventing some commonly occuring objective defects through engineering and design, the Loring roaster also gives the roast operator incredible control over the roast through rapid and comprehensive data feedback, and quick response to control inputs.

Comprehensive Data Feedback

The Loring roaster comes stock with 4 thermocouple probes to measure the air temperature throughout the system as well as the coffee bean surface temperature. Through monitoring the stack, inlet, and exhaust the roaster operator is able to fully understand the preheat conditions of the roaster as they are preparing to start a roast as well as the conditions during the roast with regards to heat being applied to the coffee. By using all of the data available, a skilled roaster operator can make informed decisions that help them avoid subjective roasting defects based on their individual thresholds and profile goals.

The Loring roaster also utilizes an incredibly thin and responsive bean temperature probe (one of the thinnest I've seen for commercial coffee roasters). This thin size at the point of measurement means that thermal lag in the data measurements is minimized and the probe is able to rapidly respond to control changes as well as changes in the bean surface temperature. This shares a similar advantage with the number of thermocouple measurements at the operator's disposal as it allows them to make informed and rapid decisions to steer their profile away from subjective roasting defects as they define them.

Fast Response to Control Input

Not only are the thermocouples quick to adapt to the changing controls of the roaster, but the roaster itself (even the 1 bagger) is able to rapidly change course when given a control adjustment. Often, in the roasting community, people talk about missing a power adjustment minutes earlier, and being forced to live with the consequences down-stream from that control change event. With Loring roasters, changes you make are reflected almost immediately. The engineering around the lower mass stainless steel drum as well as the high airflow running through the machine significantly speed up the reaction time of the machine to control changes when roasting. The bottom line is that when you say go, the machine goes. And when you say slow down, the machine responds (not literally say… as there is no connection to Alexa or Siri yet… but you get the point). All of this puts the operator comfortably in the driver's seat and not at the mercy of the heat retention of the machine.

LORING ADVANTAGE

Through design features, the Loring roaster is able to avoid two objective roast defects which are common among roasters, especially those newer to roasting. Of course profiling to avoid tipping is something everyone must deal with, and the subjective roasting defects have as much to do with profile as they do preference; but being able to roast without concern for scorching and facing is a Loring advantage.

CONCLUSION

Roasting defects can be a big deal when it comes to producing quality, specialty coffee. Whether it's that lingering, bitter, ashen character clouding the aftertaste of an otherwise beautiful coffee, or feeling like you have no control over your own machine and have a litany of subjective or objective issues. You're aware of the definitions, root causes, flavor outcomes, and means of avoidance. Take time before buying a roaster and consider feedback being given on user forums, real-life experiences of roasters you appreciate and whose experiences you value, and information provided to you by manufacturers (as well as how those stack with the end user experience). Take some time to consider the Loring roaster product line and check up on it's claims and features. You'll find nothing but a wonderful Loring representative on the other end able to answer your questions… or reach out to me (Rob Hoos). And if you find yourself facing any of these subjective or objective defects and don't know what to change or where to turn, book a time with me and I'll help get you sorted.

ROB HOOS

Coffee Roasting Consultant and Author

ABOUT THE AUTHOR

Rob is an independent coffee roasting consultant as well as director of coffee for Nossa Familia (Portland). He has served as an SCA Lead Instructor for Roaster classes as well as a member of the Roasters Guild Education Committee. He's also author of "Modulating the Flavor Profile of Coffee: One Roaster's Manifesto".

VISIT LORING.COM FOR MORE INFORMATION, TO SCHEDULE A DEMO, OR REQUEST A QUOTE.

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