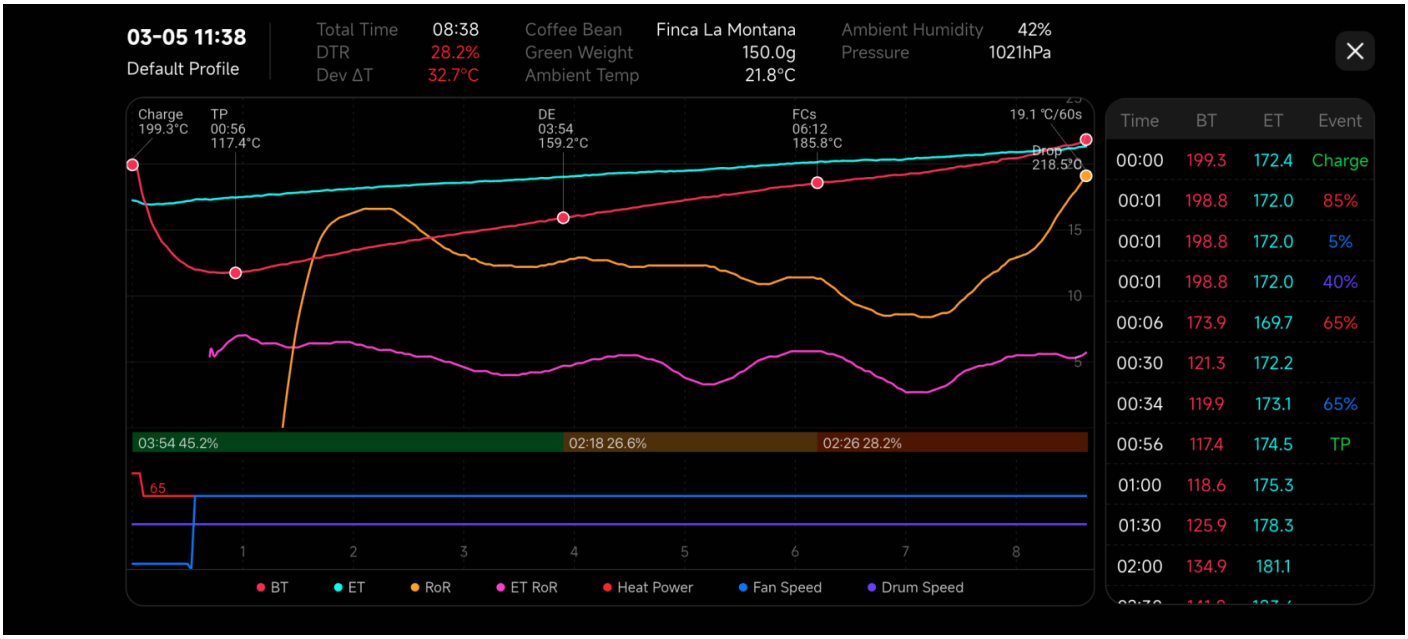
Convection Vs Radiant

This was summarized by Renatoa he runs the Home Roaster Forum.



A flat RoR indicates how radiation delivers energy relative to bean temperature. Difference comes from underlying heat transfer physics. Convection heat transfer rate follows Newton's Law of Cooling/Heating.

$Q = hA(T_{air} - T_{bean})$
Where:

Q = heat transfer rate
h = heat transfer coefficient
A = surface area
T_{air} = air temperature
T_{bean} = bean temperature

At the start T_{air} transfers to T_{bean} lots of heat high RoR. Once beans heat up less heat trasnfer and RoR declines. So if your heat input stays constant, RoR falls naturally.



Radiant heating behaves differently follows Stefan–Boltzmann law:

$Q = \sigma \epsilon (T_{source}^4 - T_{bean}^4)$
Where:
σ = Stefan–Boltzmann constant
ε = emissivity (how well beans absorb radiation)
T_hot = IR lamp temperature
T_cold = bean temperature

Lamp placement and heat get's really hot. If the formula raises temperature to the power of four energy input stays nearly constant. If Energy input remains constant and the temperature increase stays roughly constant flat RoR is produced. Then there is emissivity effect beans darken and emissivity increase. Beans absorb more IR energy later in roast so if you were to reduce heater power after drying the energy input would roughly remain constant that returns back to flat RoR.

TLDR: Flat RoR in a radiant roaster = stable energy delivery, while in convection a flat RoR usually means increasing energy input (which can taste baked or dull).

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