The KC Central America Roya CHIRPS Wet Anomaly Signal: Disease-Risk Overlay for Arabica

Why Central American coffee-belt wet-weather anomalies in Colombia, Honduras, and Guatemala serve as a 60-90 day leading indicator for Arabica supply shocks via roya leaf-rust epidemiology.

David Stendahl · Market Lab Analytics · November 5, 2026

The signal with the limits stated upfront

Three things the reader must know before the rest of this brief lands.

First, the full-distribution daily Spearman information coefficient against Arabica forward 60-day returns is plus 0.099 at p-value 5.2e-21 on a sample of 8,947 daily observations spanning 1990 through 2026. Strongly significant on the 36-year window.

Second, Phase +1 (Roya Risk Elevated) delivers plus 0.52 percentage points above baseline across 2,241 trading days (25.0 percent of sample) and Phase −1 (Dry Anomaly) delivers minus 1.30 percentage points across 2,500 days (27.9 percent). 1.82 pp directional spread.

Third, the non-overlap independence test at 60-day sampling is sign-consistent but borderline significant. Across 150 independent samples the Spearman is plus 0.124 with p-value 0.13. The signal is a slow-lead disease-risk overlay; roya outbreaks take weeks-to-months to develop from the initial wet-anomaly trigger. Treat as supply-shock setup lens not a short-horizon trigger.

• • •

The thesis: Central American roya epidemiology

Hemileia vastatrix (coffee leaf rust, known regionally as roya) is the most destructive disease of Arabica coffee and the most feared supply-shock pathway in Central America. The 2012-2013 Central American roya outbreak destroyed roughly 20 percent of the regional Arabica harvest, pushed thousands of smallholder producers out of production permanently, and contributed to a KC price rally of roughly 73 percent peak-to-trough.

The epidemiology of the disease is well-understood. Prolonged leaf wetness during the April-October Central American wet season is the key trigger for roya infection and sporulation. When

precipitation runs well above the 5-year norm across the Colombia, Honduras, and Guatemala coffee belts, roya pressure elevates and Arabica supply shocks follow 60-90 days later. When precipitation runs below the 5-year norm, disease pressure drops.

The signal takes CHIRPS daily precipitation across the three coffee-belt regions, computes rolling 90-day cumulative precipitation, z-scores on a 5-year rolling window, averages across the three regions, and tanh-bounds. State thresholds plus or minus 0.2 (moderate) and plus or minus 0.5 (extreme). Phase +1 at composite above +0.3, phase −1 below −0.3. Target: ICE US Coffee C first-nearby back-adjusted close.

Historical window: CHIRPS series from 1981; engine runs from 1990 onward with 504-bar warmup.

What the firings have actually done

Computed over 8,947 daily observations post-warmup from 1990 onward. The baseline Arabica forward 60-day return is mean plus 2.32 percent and median minus 0.96 percent across the live-window sample.

> **Baseline Arabica forward 60-day return:** mean plus 2.32 percent / median minus 0.96 percent across the live-window sample.
>
> **Daily Spearman IC (fwd 60d):** plus 0.099, p-value 5.2e-21, N equals 8,947. Strongly significant.
>
> **Non-overlap IC (60-day step):** plus 0.124, p-value 0.13, N equals 150. Sign-consistent, borderline significant.
>
> **Phase-conditional forward 60-day Arabica returns:** Phase +1 (Roya Risk Elevated, 2,241 days / 25.0 pct): plus 2.84 percent, edge plus 0.52 pp. Phase 0 (On Trend, 3,508 days / 39.2 pct): plus 3.12 percent, edge plus 0.81 pp. Phase −1 (Dry Anomaly, 2,500 days / 27.9 pct): plus 1.02 percent, edge minus 1.30 pp.
>
> 1.82 pp directional spread between Phase +1 and Phase −1. Slow-lead disease-risk pattern.

Three findings. The daily IC is strongly significant on the 36-year window. The Phase −1 Dry Anomaly bucket carries the sharper directional signal (minus 1.30 pp) while Phase +1 Roya Risk Elevated is more modest (plus 0.52 pp). The signal fires primarily as a disease-risk setup lens where the asymmetry reflects the biological truth that dry anomaly reliably suppresses disease while wet anomaly only elevates probability; actual outbreak requires additional pathogen factors.

Three cases that frame how to read the signal

The canonical anchors are the 2012-2013 Central American roya outbreak, the 2010 wet-season anomaly, and the 2018-2019 dry-anomaly cycle-low.

Case 1: The 2012-2013 Central American roya outbreak

Roya Risk Elevated firing in the lead-up to the 2012-2013 Central American Hemileia vastatrix outbreak that destroyed roughly 20 percent of the regional Arabica harvest. The wet-season precipitation anomaly in the Colombia, Honduras, and Guatemala coffee belts had run above the 5-year norm

through 2011-2012 creating the epidemiological conditions for the subsequent outbreak. Composite held in Phase +1 territory through the wet-anomaly buildup. KC traded higher by roughly 73 percent peak-to-trough through the outbreak period consistent with the Phase +1 supply-shock pattern.

Case 2: The 2010 wet-season anomaly

Roya Risk Elevated firing in Q2 2010 as the wet season began with precipitation well above the 5-year norm across the three Central American coffee belts. Composite held in Phase +1 territory consistent with elevated disease-risk setup for Arabica. This episode demonstrated the wet-anomaly signal firing in an earlier cycle before the 2012-2013 outbreak.

Case 3: The 2018-2019 dry-anomaly cycle-low

Dry Anomaly firing through 2018-2019 as Central American precipitation ran below the 5-year norm consistent with low disease pressure. Composite held in Phase −1 territory through the cycle-low Arabica pricing regime consistent with sub-baseline forward returns. The textbook bearish disease-risk anchor.

How to use this signal today

Composite is currently reading minus 0.001 in the On Trend band. The Neutral phase began October 2026, 25 trading days ago. Central American coffee-belt precipitation has run near the 5-year z-score mean through 2026 consistent with neutral roya disease-risk regime.

Pair with the following for stacked conviction: ENSO dipole (Pacific-to-Central-America teleconnection driver), CHIRPS Brazil rainfall (different coffee region), USDA PSD Colombia-Honduras-Guatemala production (fundamental supply confirmation), and the ICO ICIP YoY benchmark. This disease-risk signal gives the Central American supply-shock setup lens; pair with regional supply and global benchmark signals for the full read.

Reader rule: Roya Risk Elevated firings flag bullish supply-shock setup regimes with Arabica strength historically following at 60-day horizon. Dry Anomaly firings flag bearish low-disease regimes.

Methodology

Data source: UCSB Climate Hazards Center CHIRPS daily precipitation across Colombia, Honduras, and Guatemala coffee-belt grid cells. Computation: rolling 90-day cumulative precipitation, 5-year rolling z-score, averaged across the three regions, tanh-bounded. State thresholds plus or minus 0.2 (moderate) and plus or minus 0.5 (extreme). Phase +1 at composite above +0.3, phase −1 below −0.3. Target: ICE US Coffee C first-nearby back-adjusted close.

Historical window: CHIRPS daily precipitation series from 1981; engine runs from 1990 onward with a 504-bar warmup for the rolling z-score.

Validation computed on 8,947 post-warmup daily observations. Daily Spearman IC plus 0.099 at p-value 5.2e-21 across 8,947 observations, strongly significant on 36-year sample. Phase +1 per-day forward return plus 2.84 percent (plus 0.52 pp above plus 2.32 percent baseline). Phase −1 per-day forward return plus 1.02 percent (minus 1.30 pp below baseline). 1.82 pp directional spread. Non-overlap IC at 60-day sampling plus 0.124 at p-value 0.13 across 150 samples, sign-consistent but borderline significant.

What this signal does not cover

The signal does not capture roya pressure in Brazil, Mexico, or other Arabica-producing countries outside Colombia-Honduras-Guatemala. It does not cover other Central American diseases (broca coffee berry borer, coffee berry disease). It does not cover the actual outbreak development pathway; the signal is a wet-anomaly setup lens only. Fresh country-level production signals and ICO industry reports confirm or refute outbreak development after the setup fires.

Disclaimer

This brief and the signal it describes are for informational purposes only and do not constitute investment, legal, tax, or trading advice. Hypothetical or simulated performance results have certain inherent limitations. Unlike an actual performance record, simulated results do not represent actual trading. Also, since the trades have not been executed, the results may have under- or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity. Simulated trading programs in general are also subject to the fact that they are designed with the benefit of hindsight. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. The phase-conditional forward-return stats reported above are a full-sample unconditional measurement. Readers should consult a licensed financial professional before taking any trading action.

References

UCSB Climate Hazards Center, Climate Hazards InfraRed Precipitation with Stations (CHIRPS) dataset, chc.ucsb.edu/data/chirps.

Avelino, J., Cristancho, M., Georgiou, S. et al. (2015). The coffee rust crises in Colombia and Central America (2008-2013): impacts, plausible causes and proposed solutions. Food Security 7, 303-321.

ICE Futures US, Coffee C first-nearby back-adjusted continuous contract (ticker KC), end-of-day settlement.