The Iowa Minimum Temperature Frost Risk Signal, A Planting-Window Weather Lens

Reading daily minimum temperature for Iowa (OpenMeteo state-aggregate), z-scored on 5-year rolling and polarity-inverted so cold reads positive. Planting-season frost-risk fires strongest April through May. Daily Spearman IC plus 0.097 at p-value 3.3e-20.

David Stendahl · Market Lab Analytics · November 2, 2026

What this signal is, with the limits stated upfront

Iowa produces roughly 17 percent of US corn, the single largest state share. A late-spring freeze across Iowa during the planting window delays emergence, compresses the growing season, and pushes pollination and grain-fill into less favorable later weeks. The signal reads daily minimum temperature across Iowa and surfaces cold-anomaly readings that correlate with downstream yield-risk setups.

The signal reads OpenMeteo Iowa state-aggregate daily minimum temperature, z-scores on a 5-year rolling window, and polarity-inverts so cold reads positive composite. Composite above plus 0.5 is Cold Frost Risk. Composite below minus 0.5 is Warm No Frost Risk. The middle band is Neutral.

Current reading, as of October 30, 2026: composite minus 0.20, Neutral band. We are OUTSIDE the planting-season live window (April-May); current reading is off-season drift reflecting October temperature cycles rather than active frost-risk firing.

Daily Spearman IC against CBOT Corn fwd 60-day return is plus 0.097 at p-value 3.3e-20 across 8,984 live-signal days. State-conditional per-day means: Warm No Frost Risk delivers minus 0.07 percent (edge minus 0.36 pp below the plus 0.29 percent baseline), Neutral delivers plus 0.33 percent (edge plus 0.04 pp), Cold Frost Risk delivers plus 0.75 percent (edge plus 0.46 pp). Clean monotone directional structure in the author-thesis direction (cold = bullish corn via yield-risk).

Limits upfront: the frost-risk mechanism is operative during the April-May planting window. Readings outside this window reflect seasonal temperature cycles rather than active frost firing. Iowa dominates US corn but the signal does not cover the other I-States (Illinois, Nebraska, Minnesota, Indiana) that collectively grow another 44 percent of US production.

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How the frost-risk composite composes

Direct observation: OpenMeteo Iowa state-aggregate daily minimum temperature. Averaged across Iowa weather stations.

Derived comparison: 5-year rolling z-score of the daily Tmin series. Polarity-inverted (cold Tmin = positive composite). Tanh-bound to minus 1 to plus 1.

State thresholds. Composite above plus 0.5 is Cold Frost Risk. Composite below minus 0.5 is Warm No Frost Risk. The middle band is Neutral.

The signal has a strong SEASONAL CYCLE in the composite reading because the z-score is on the raw temperature series (not same-day-of-year baseline). Winter readings bias positive (cold); summer bias negative (warm). The MECHANISM fires during April-May planting season; off-season readings reflect the seasonal cycle rather than mechanism firing.

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What the state-conditional returns have actually done

> **Reference baseline, CBOT Corn fwd 60-day unconditional**
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> CBOT Corn back-adjusted continuous forward-60-day return baseline over the full sample window of 1990-11-29 through 2026-10-30: mean plus 0.29 percent, median minus 1.01 percent, standard deviation 10.89 percent, percent negative 56.6 percent.

Warm No Frost Risk (composite below minus 0.5) covers 44.5 percent of the sample. Per-day mean minus 0.07 percent, edge minus 0.36 pp below baseline. Mild bearish-corn signature.

Neutral (composite between minus 0.5 and plus 0.5) covers 17.9 percent of the sample. Per-day mean plus 0.33 percent, edge plus 0.04 pp above baseline.

Cold Frost Risk (composite above plus 0.5) covers 37.6 percent of the sample. Per-day mean plus 0.75 percent, edge plus 0.46 pp above baseline. The author-thesis-aligned bullish-corn state.

Directional spread: plus 0.82 pp from Warm to Cold. The spread is modest because off-season readings dilute the in-season firing power.

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Three cases that frame how to read this signal

Case 1: April-May 2013. Cold spring frost-risk firing.

A persistent cold April-May 2013 drove Iowa Tmin into Cold Frost Risk extreme. The downstream Corn Development Pace signal reflected the delay. Corn front-month held firm through June on the compressed-planting-window risk, consistent with the author thesis.

Case 2: April-May 2012. Warm no-frost spring counter-case.

The 2012 warm March-May pulled Iowa planting forward with no frost disruption. Composite fired into Warm No Frost Risk through this period. Corn drifted on the comfortable-planting setup before the July drought flipped the summer story.

Case 3: May 2019. Cold wet planting season.

Record 2019 flooding was accompanied by persistent cold temperatures. The frost-risk signal fired into Cold Frost Risk extreme, compounding the moisture-driven planting delays. Corn initially rallied on prevent-plant concerns.

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How to use the signal today

As of November 2, 2026, the composite reads minus 0.20 and the state is Neutral. We are outside the planting-season live window; current reading is off-season drift.

Watch for the April-May 2027 window when the frost-risk mechanism re-activates. Pair with three confirming reads during the live window:

- **Z4389 Corn Emerged Pace.** The downstream emergence signal. Direct physical effect of frost-risk firings.
- **Z3754 Corn Development Pace.** The planting-emergence composite. Reads the aggregate downstream effect.
- **Z4339 NOAA Nino 3.4 SST Anomaly.** The ENSO climate lead. La Nina patterns can increase late-spring cold-outbreak frequency.

The frost-risk signal is a planting-season weather lens; use alongside pace signals during the live window.

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Methodology notes

Data sources. OpenMeteo Iowa state-aggregate daily minimum temperature.

Signal construction. 5-year rolling z-score of daily Tmin. Polarity-inverted (cold = positive composite). Tanh-bound to minus 1 to plus 1. State thresholds plus or minus 0.5 extreme and plus or minus 0.2 moderate. Target: CBOT Corn back-adjusted continuous.

Validation statistics. Daily Spearman IC against CBOT Corn fwd 60-day return is plus 0.097 at p-value 3.3e-20 across 8,984 live-signal days. Three-regime per-day means: Cold Frost Risk plus 0.75 percent (edge plus 0.46 pp vs plus 0.29 percent baseline), Neutral plus 0.33 percent (edge plus 0.04 pp), Warm No Frost Risk minus 0.07 percent (edge minus 0.36 pp).

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What this signal does not cover

First, the signal reads Iowa only. Other I-States (Illinois, Nebraska, Minnesota, Indiana) that together grow another 44 percent of US corn are not captured.

Second, the mechanism is operative only during the April-May planting window. Off-season readings reflect seasonal temperature cycles rather than active frost firing.

Third, the signal uses raw Tmin z-score (not same-day-of-year baseline), so the composite has strong seasonal bias in the reading itself. Read with awareness of the live-window gating.

Fourth, actual frost damage depends on crop development stage. Pre-emergence frost is less damaging than post-emergence frost; the signal does not distinguish.

This research brief is for informational purposes only and does not constitute investment advice. Data sources: OpenMeteo Iowa state-aggregate daily minimum temperature, CBOT Corn back-adjusted continuous target. State-conditional statistics computed through 2026-10-30.