

Removing beer matrix inhibitors recovered spoilage bacteria in all 17 beverages tested, on both benchtop and portable qPCR.

Simplifying Brewery Microbiology: Validation of a Portable On-Site qPCR Platform for Beer Spoilage Bacteria and Wild Yeast Detection

Aakaanksha Maddineni, MS* · Nicole Lawrence, MS · Lorenzo D’Alessio, MS · Max Derbyshire, MPH*
Acorn Genetics, Chicago, IL · *Presenting authors

BACKGROUND

Conventional plating takes 3-10 days and does not recover viable but non-culturable lactic acid bacteria (LAB). qPCR is faster, but compounds in beer can inhibit amplification.

We evaluated Acorn sample preparation across beer and cider matrices and compared portable SENTRI with benchtop qPCR.

METHODS

Enrichment study. A separate tenfold dilution series was enriched for 48 h. LAB and hop-resistance targets were read on QuantStudio 5 and SENTRI.

Matrix study. Sixteen beers and one hard cider were spiked with *P. damnosus* (10⁴ CFU/mL), then tested with and without inhibitor removal. Unspiked beverages established native LAB status; a spiked matrix-free reference served as a positive control.

Section 1 establishes the lowest contamination level detected. Section 2 tests detection across beverage matrices and inhibitor profiles.

1 Sensitivity after enrichment

1 CFU/mL of *P. damnosus* detected after 48 h enrichment on both instruments; a third-party assay detected 10 CFU/mL

Starting CFU/mL	QuantStudio 5		SENTRI	
	LAB	Hop	LAB	Hop
1,000	26.6	29.4	27.6	29.1
100	29.9	32.7	29.8	32.4
10	32.9	38.0	32.0	34.5
1	34.1	ND	34.0	ND
0.1	ND	ND	ND	ND

READING THE RESULT

The table reports starting cell concentrations before enrichment, not cells per qPCR reaction.

LAB was detected at 1 CFU/mL and hop-resistance targets at 10 CFU/mL on both instruments.

Table 1. Observed Ct values after 48 h enrichment; ND = not detected. LAB and Hop denote the bacterial and hop-resistance targets. Selected observations, not a replicate-based limit of detection.

2 Detection across beverage matrices

LAB detected in 17/17 with Acorn preparation, versus 6/17 on QuantStudio 5 and 8/17 on SENTRI without inhibitor removal.

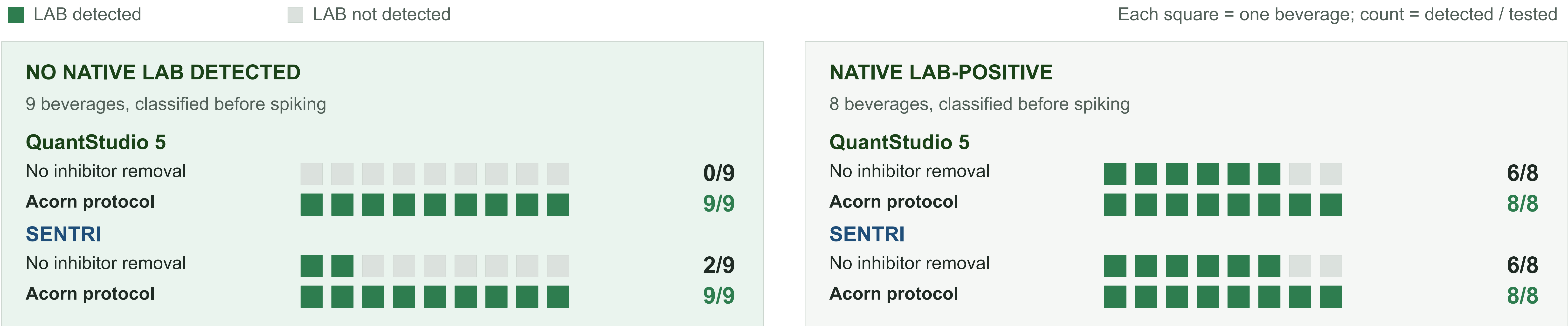


Figure 1. LAB detection after a 10⁴ CFU/mL spike. Native-positive beverages are shown separately because their positive calls cannot be attributed to the spike alone. A spiked reference without a beverage matrix was detected with both preparations on both instruments and is excluded from the counts.

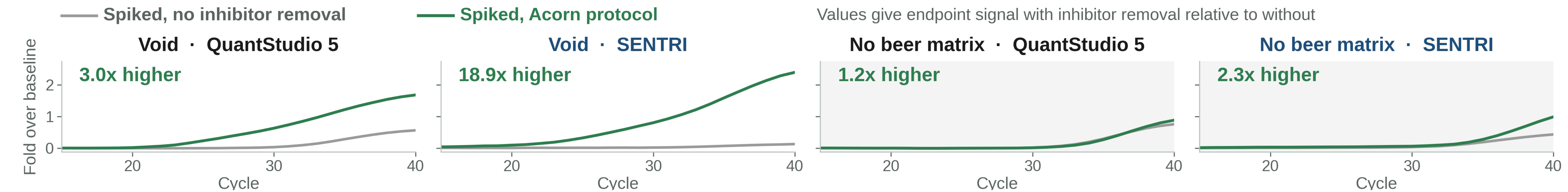


Figure 2. Hop-resistance target signal with and without inhibitor removal, in a spiked farmhouse ale and in a spiked reference without a beverage matrix.

3 Portable versus benchtop instrument

SENTRI and QuantStudio 5 returned the same target calls with the Acorn protocol.

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Matching target calls

36 matrix-panel and 10 dilution-series calls, Acorn protocol

≤ 1 cycle

LAB Ct difference

Between instruments at each detected dilution

< 1 hour

Hands-on time

Reported for the Acorn workflow