RESHAPE

APPLICATION NOTE

Radial Growth Rates

Automating growth rate measurements

APPLICATION

Automating radial growth rate measurements with high-resolution imaging and AI

Why is it a critical need?

Radial growth rate assays are widely used to assess fungal fitness, inhibition, and environmental responses, but traditional manual workflows severely limit their value. Manual measurements are time-consuming, low-throughput, and typically rely on single end-point data, missing key biological dynamics such as lag phase shifts, early growth kinetics, and subtle stress responses. As experiments scale across strains, media, and inhibitors, reproducibility and consistency become difficult to maintain. High-frequency imaging generates rich, time-resolved data, but interpreting these datasets without automation is impractical. Automation and AI are therefore essential to capture continuous growth profiles, reduce human bias, improve reproducibility, and unlock the full biological insight contained within radial growth assays.

How does Reshape help?

Reshape modernizes radial growth rate measurements by fully automating incubation, imaging, and data analysis in a single integrated platform. The Reshape Smart Incubator captures high-frequency, time-resolved images of growing colonies, while the Reshape Discovery Platform uses AI-driven image analysis to automatically quantify colony expansion and growth kinetics. This enables researchers to generate continuous growth curves, compare strains and conditions, and detect inhibitory or stress effects with high precision and reproducibility. The platform scales seamlessly from small studies to high-throughput screens, minimizing manual labor while increasing data density. By delivering standardized, insight-ready datasets, Reshape helps researchers make faster, more confident decisions across food, pharma, agriculture, and industrial biotechnology.

Introduction

Measuring the radial growth rate of fungi is a fundamental method for quantifying colony expansion and understanding how environmental conditions or inhibitory compounds influence growth dynamics.

These measurements are widely used to evaluate antifungal efficacy in food preservation and cosmetic formulations, as well as to optimize growth media and culture conditions across research and industrial settings.

Reshape's platform modernizes this established workflow by combining automated incubation and imaging with high-throughput assay design and streamlined data analysis. This transforms traditionally manual, low-throughput measurements into standardized, insight-ready datasets, reducing hands-on time while increasing reproducibility and data density.

KEY APPLICATION AREAS

Optimization of growth media

Essential for tailoring growth conditions across a wide range of environmental and nutritional variables.

Inhibitory effects

Critical for testing antifungal agents and developing preservation strategies across industries such as food and cosmetics.

Pharmaceutical development

Supports antifungal drug discovery and performance testing of fungicides.

Agriculture

Enables studies of crop diseases and soil health, where fungal pathogens represent a major global threat to yield and crop stability.

Industrial processes

Supports optimization of fermentation and bioprocessing workflows and characterization of fungal morphologies under varying conditions.

SHOWCASE STUDY 1

To compare the radial growth rates of multiple fungal strains cultured under identical conditions, and to demonstrate how automated imaging enables high-resolution growth profiling and straightforward strain-to-strain comparison.

Materials & Methods

Five fungal strains, including Aspergillus spp., were pin-inoculated onto Potato Dextrose Agar (PDA; Neogen) plates in triplicate. Plates were incubated in the Reshape Smart Incubator and imaged automatically at a capture interval of one image per hour, enabling fine-grained resolution of colony expansion over time.

Images were analyzed using the Reshape Discovery Platform, where colony area (mm^2) was quantified for each time point. Growth curves were generated for each strain, and results are presented as the mean colony area ± standard deviation across three biological replicates per strain.

Results

The complete dataset is available upon reasonable request.

Automated analysis produced immediate aggregated insights within the Reshape Discovery Platform (Figure 1), including time-resolved growth curves, time-of-appearance, and visually tracked inter-replicate variability. The median growth trajectories for the five fungal strains cultured on PDA over approximately 140 hours (Figure 2) revealed pronounced differences in radial growth rates between strains, alongside measurable inter-colony variability that became most evident as colonies approached their peak growth phase.

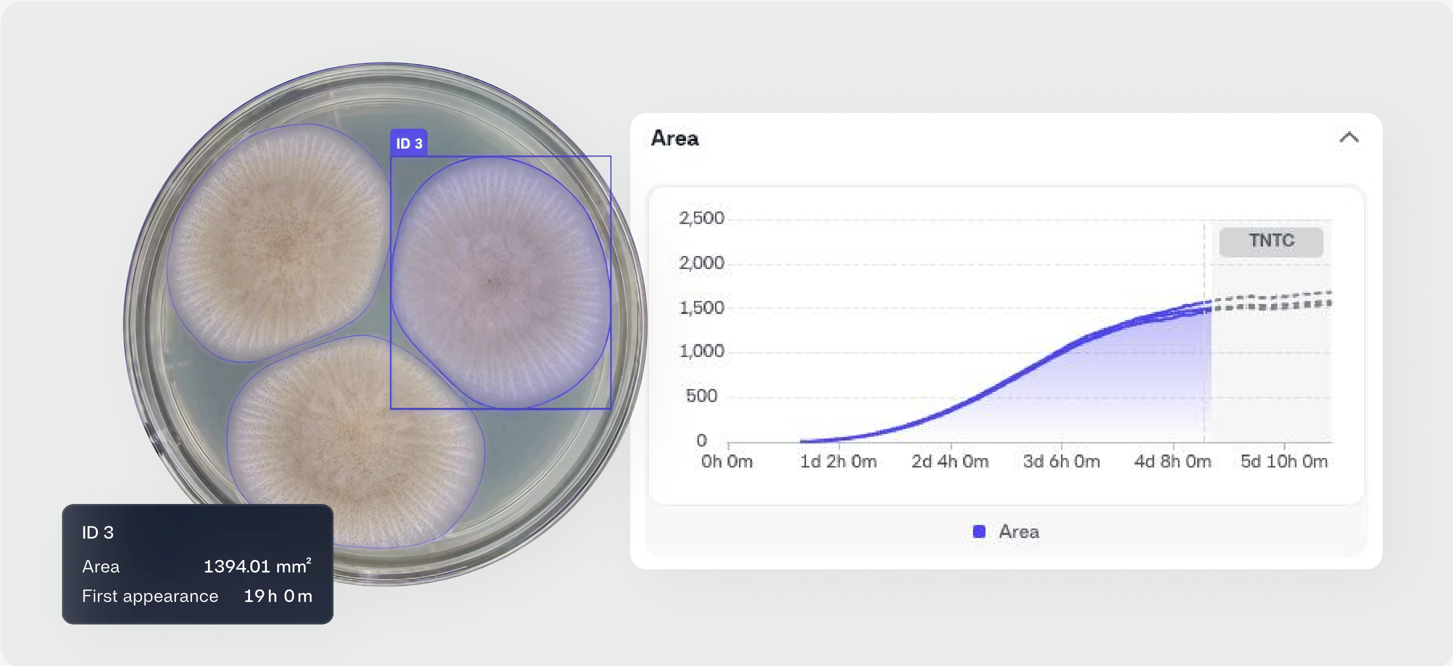

Figure 1. Immediate aggregated growth insights for Aspergillus spp. (Strain 1) generated in the Reshape Discovery Platform.

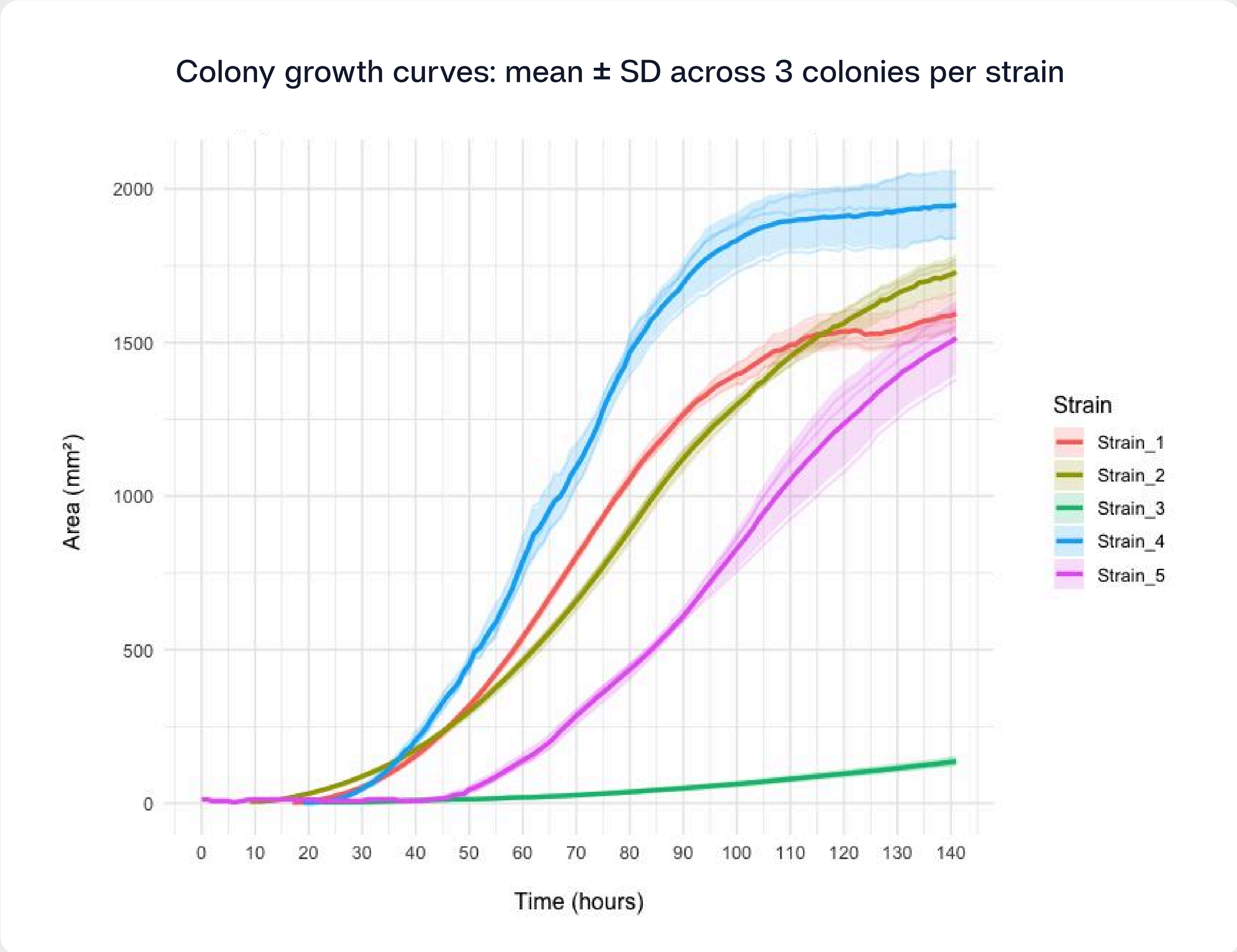

Figure 2: Median colony growth curves (area, mm^2) ± standard deviation across five fungal strains cultured on PDA.

Discussion

Clear and reproducible differences in radial growth dynamics were observed between the tested fungal strains (Figure 2). Several strains exhibited rapid exponential expansion following a short lag phase, reaching large colony areas within the first 80–100 hours of incubation. In contrast, other strains showed delayed onset of growth and substantially reduced final colony size, indicating strain-specific differences in growth rate and overall fitness under these conditions.

The separation between growth curves becomes particularly pronounced during the exponential phase, highlighting the value of high-frequency imaging. Hourly measurements captured subtle differences in early growth kinetics that would be difficult to resolve using manual end-point measurements alone. Importantly, the relatively narrow standard deviations across replicates demonstrate good experimental consistency and underscore the robustness of automated imaging and analysis.

SHOWCASE STUDY 2

Investigate the impact of different NaCl concentrations on radial growth of two fungal strains cultured on Potato Dextrose Agar (PDA; 24 g/L Neogen PDA media).

Materials & Methods

Media Preparation: Potato Dextrose Agar (Neogen) was prepared and supplemented with NaCl to the following final concentrations:

- 2.0 M
- 1.0 M
- 0.5 M
- 0.25 M

Inoculation: Three fungal strains were tested individually. Each strain was pin-inoculated onto PDA plates at each NaCl concentration in triplicate.

Incubation & Imaging: Plates were incubated and imaged in the Reshape Smart Incubator at a capture interval of one image per hour, enabling fine-grained resolution of colony expansion over time. Images were analyzed using the Reshape Discovery Platform to quantify colony expansion over time.

Data Export & Post-Processing: Radial growth data were exported as an Excel spreadsheet and post-processed to calculate growth rates and compare conditions across strains.

Comparison between strains: Raw image outputs of the three strains (rows) and five salt concentrations (columns).

Discussion

Growth rates measured between 20 hours and 70 hours reveal a clear, concentration-dependent effect of NaCl on fungal fitness. Both strains show enhanced growth at low to moderate NaCl concentrations (0.25–0.5 mol/L), followed by a sharp decline at higher salinity, indicating a non-linear response to osmotic stress.

Across all conditions, Strain 1 consistently outperforms Strain 2, with the largest differences observed at moderate salt levels, suggesting superior salt tolerance. At high NaCl concentrations (≥1 mol/L), growth is strongly inhibited in both strains, though Strain 1 retains a higher residual growth rate.

These results demonstrate how time-resolved imaging can be used to quantify strain-specific fitness and stress tolerance across environmental gradients in a reproducible, colony-level assay.

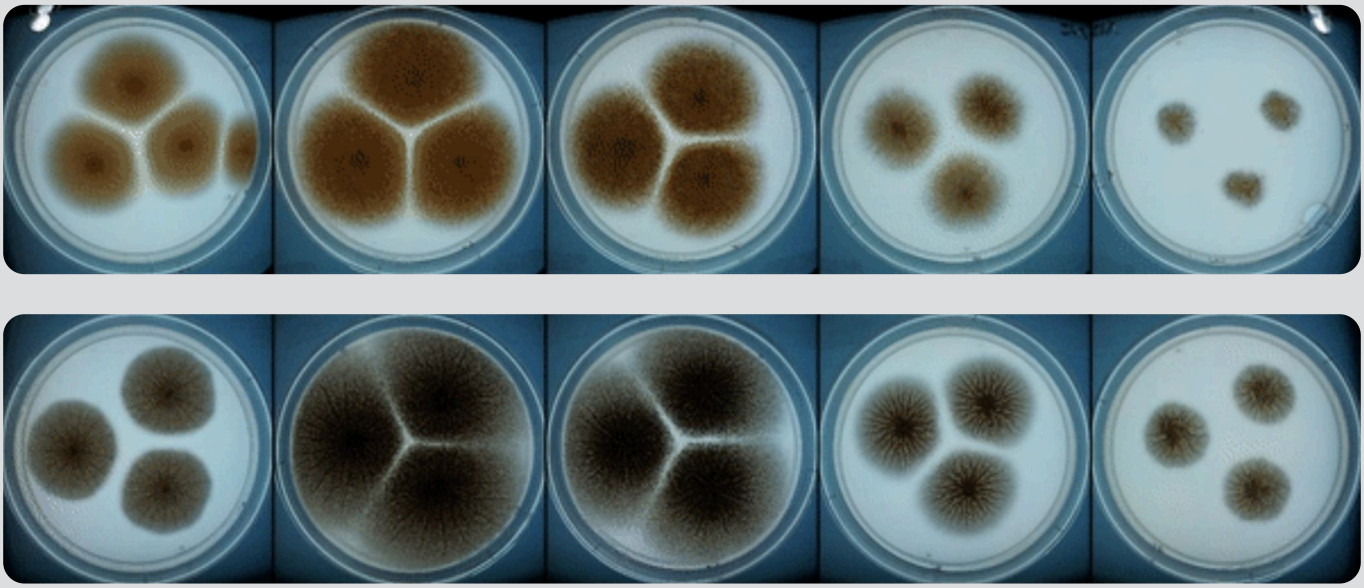

Figure 3. Automatic data acquisition by Reshape's Smart Incubator capturing two fungal isolates growing on PDA over 70 hours at changing salt concentrations (NaCl 0, 0.1, 0.25, 0.5, 1, 2 mol/L)

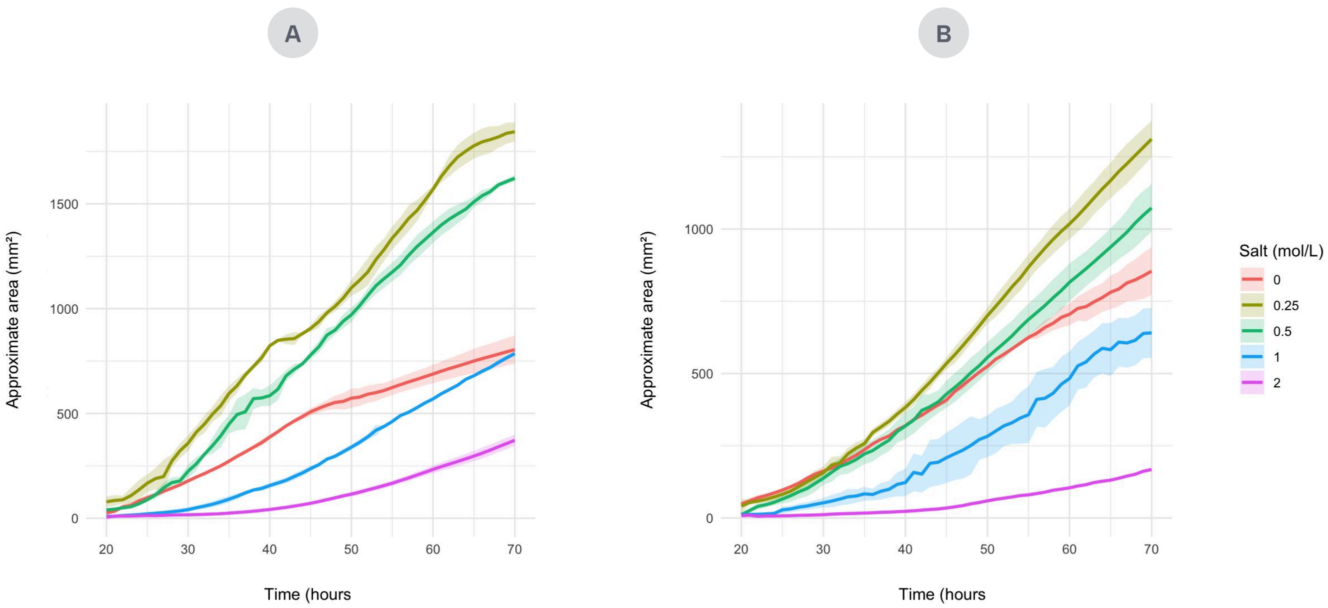

Figure 4. Growth rates of two Aspergillus spp. strains **A.** strain 1 and **B.** strain 2, growing on PDA over 70 hours at changing salt concentrations (NaCl 0, 0.1, 0.25, 0.5, 1, 2 mol/L)

Fungal strain fitness vs. NaCl concentration

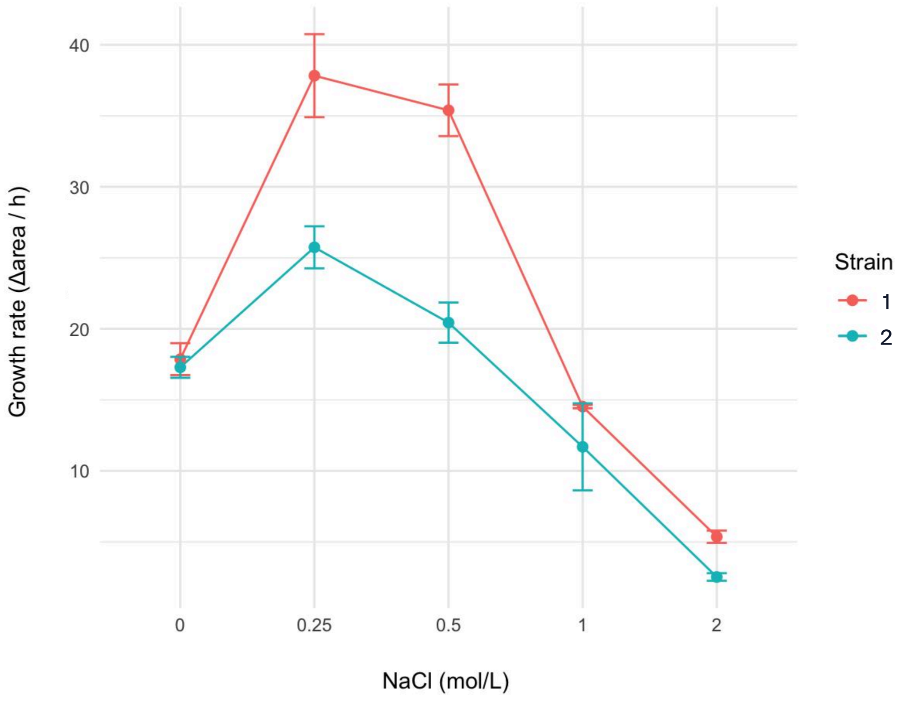

Figure 5. Fungal strain fitness at various salt concentrations, showing a similar trend for both strains tested, with increased growth rates at lower NaCl concentrations (0.25, 0.5 mol/L) compared to higher concentrations.

Benefits

Efficiency for scientists and lab technicians

Minimizes manual work, freeing time for more impactful tasks

Informed decision making for R&D managers

Predictable results and lower project target risks enhances commercial outcomes

Scalability

Adaptable to a range of study scales and number of factors—even suitable for downscaling for very high throughput applications.

Conclusion

From an application perspective, these results illustrate how radial growth assays can be used to:

- Rapidly screen and rank fungal strains based on growth performance
- Quantify inhibitory effects as shifts in lag phase, growth rate, or maximum colony size
- Support media optimization by directly comparing growth dynamics under different formulations
- Generate high-confidence, time-resolved datasets suitable for downstream statistical analysis

By automating both data acquisition and analysis, the Reshape platform enables researchers to move beyond single-time-point measurements and instead work with continuous growth profiles, providing deeper biological insight while significantly reducing manual workload. The Reshape Microbiology Platform brings a modern approach to radial growth assays for fungi, enabling high-throughput automation and precise data analysis.
It opens up avenues for innovation across food preservation, pharmaceuticals, agriculture, and beyond.