MACHINE VISION FOR SEEDLING GROWTH MEASUREMENT

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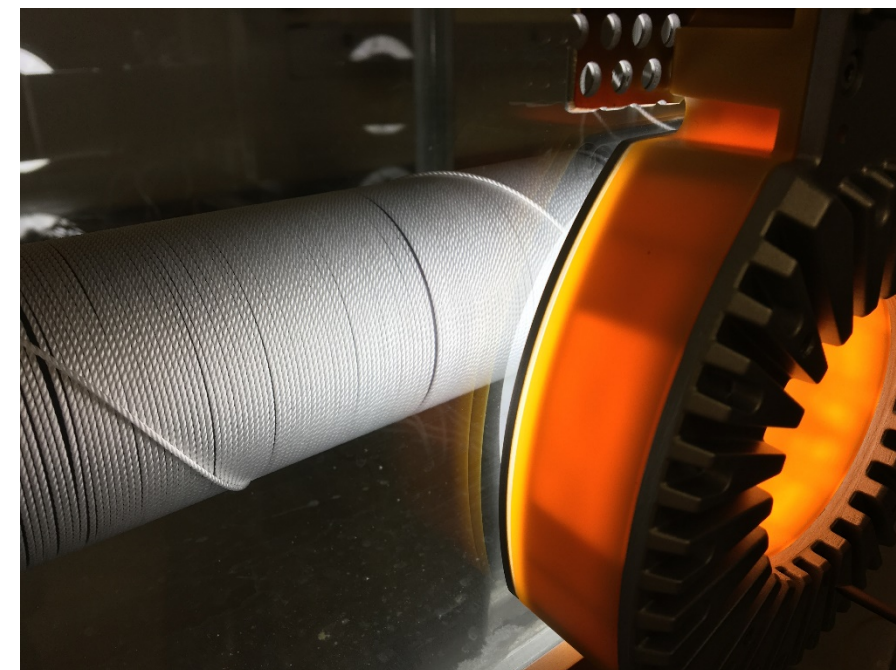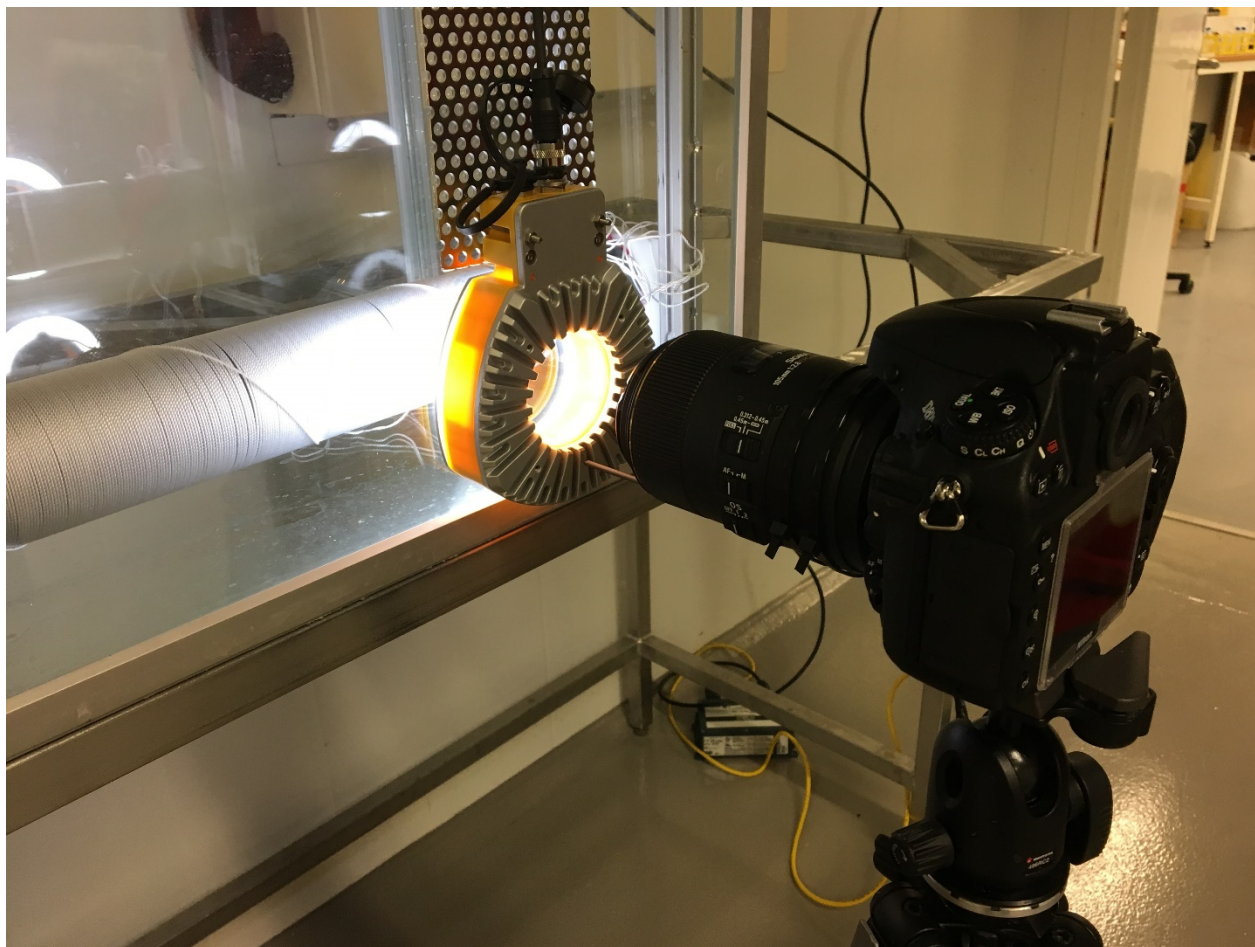
Problem

Quantification of the amount of substrate growth

- Differentiate between substrate and seedlings

- Substrate; white-ish

- Seedlings; brown-ish

- *How to set a number on these concepts..?*
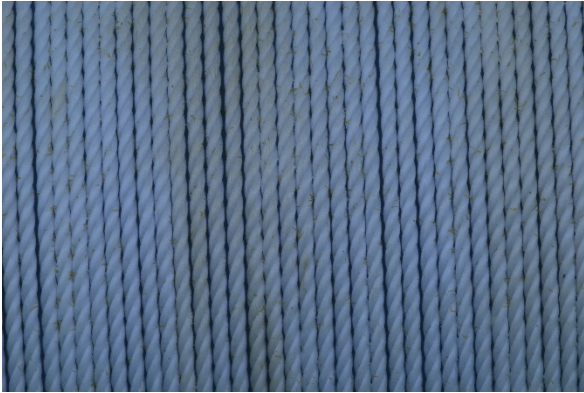

- Simplification: **What is white is not growth**

Image collection

- High resolution DSLR
- White ring-light
- In sea-water

SINTEF

Examples from the Macrosea sampling program

13. Januar 2017 (0%)

16. Januar 2017 (12%)

20. Januar 2017 (16%)

23. Januar 2017 (61%)

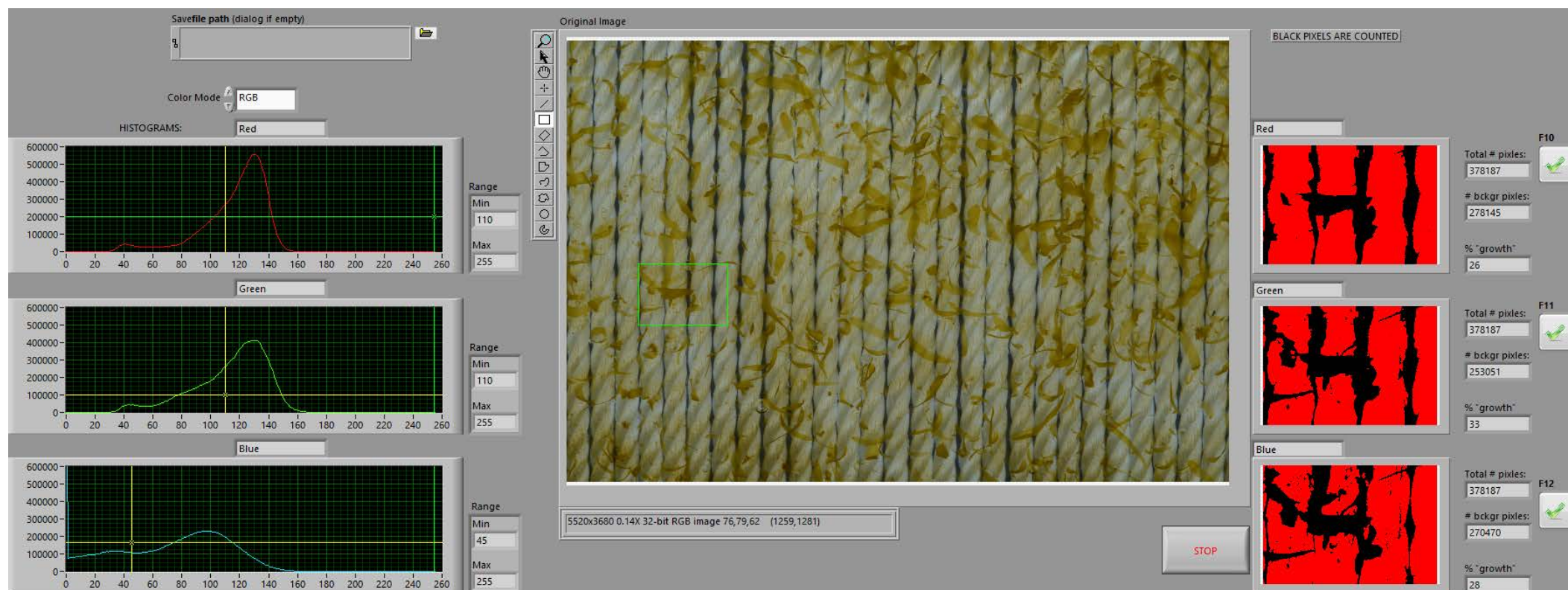26. Januar 2017 (73%)

30. Januar 2017 (83%)
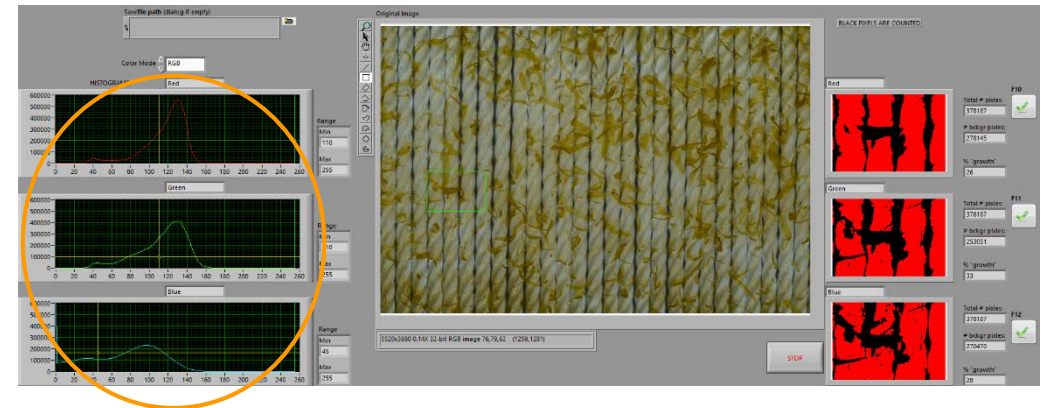
2. Februar 2017 (84%)

6. Februar 2017 (89%)

User interface

Method

A dedicated application for image processing:

- Allows the user to choose a ROI (region of interest) for further analysis.

- Extracts the selected color plane: Four different colour formats may be selected; RGB, HSL, HSV and HSI. For this task the RGB (Red, Green, Blue) format was selected.

- Displays the histograms for the selected colour format
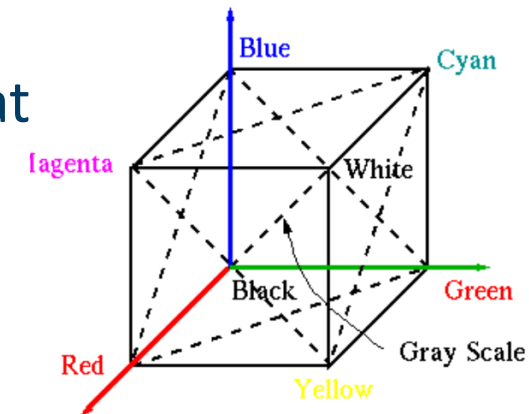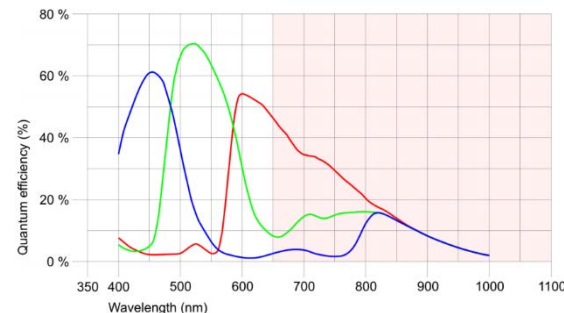
Method

- Results can immediately be visually checked on the right side of the user interface

- Three images (one from each colour channel: e.g. R, G and B) are then converted into a binary image, using the selected thresholds

- Each binary image is treated using morphological operators: Erosion and dilation
  - Erosion: Shrinks objects and removes noise
  - Dilation: Expands objects, fills holes, smoothing
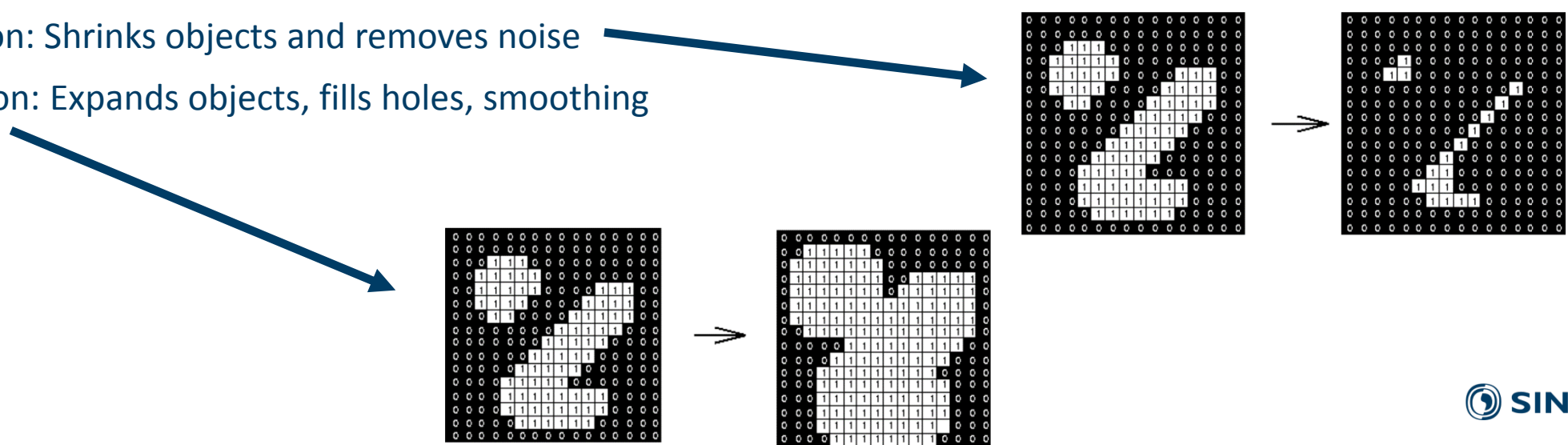
Method

BW image from Blue channel:

Binary image from thresholding:

Method

- Binary images consists of 0 and 1's

- The growth is calulated using the **ratio of 1's to total no. of image pixels**

- The threshold level gives the growth and should represent it accurately

- Binary images are displayed, along with the "% growth"

- One of the results is selected (the most representative) and stored in a file along with image name
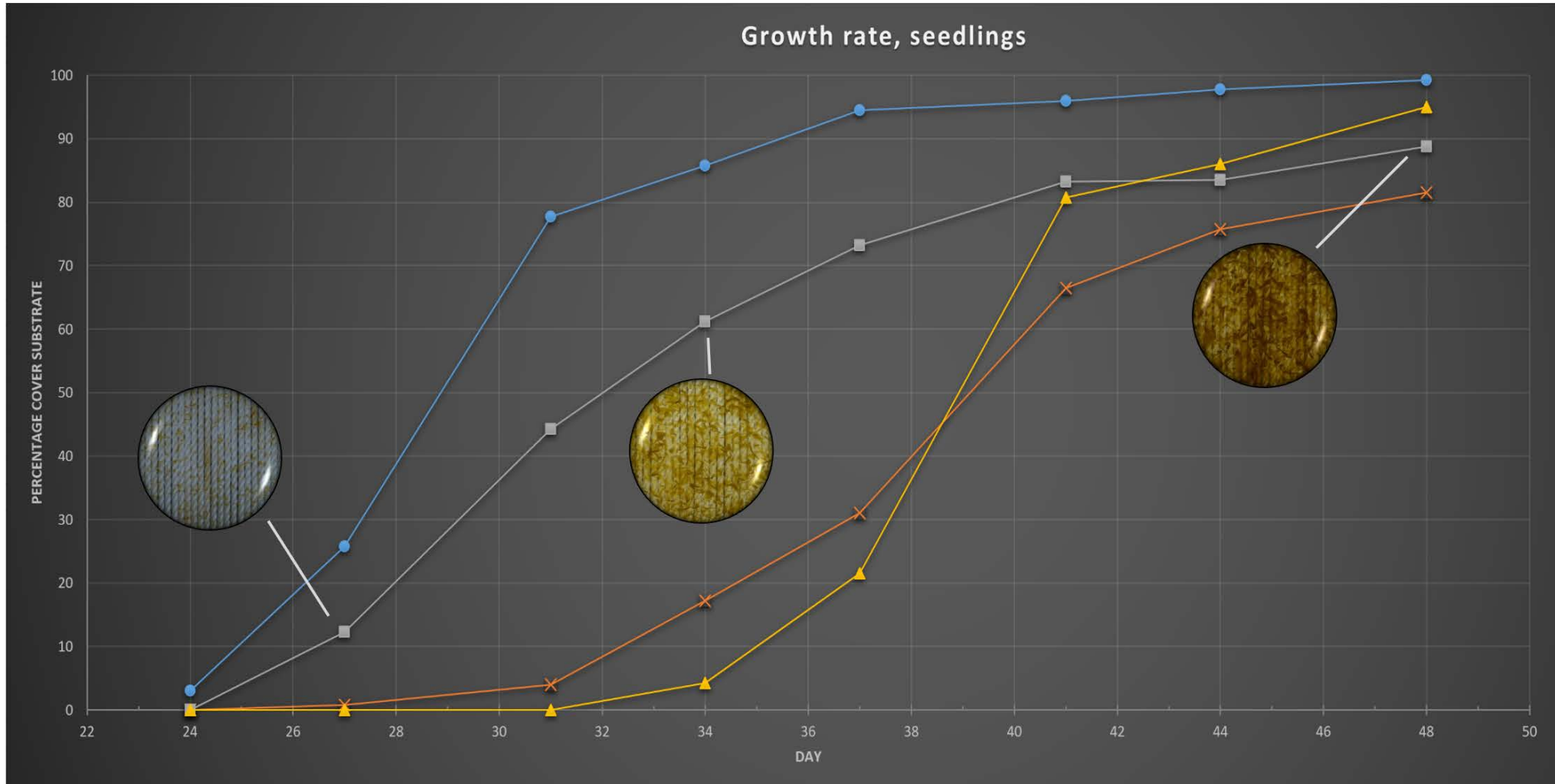
Method
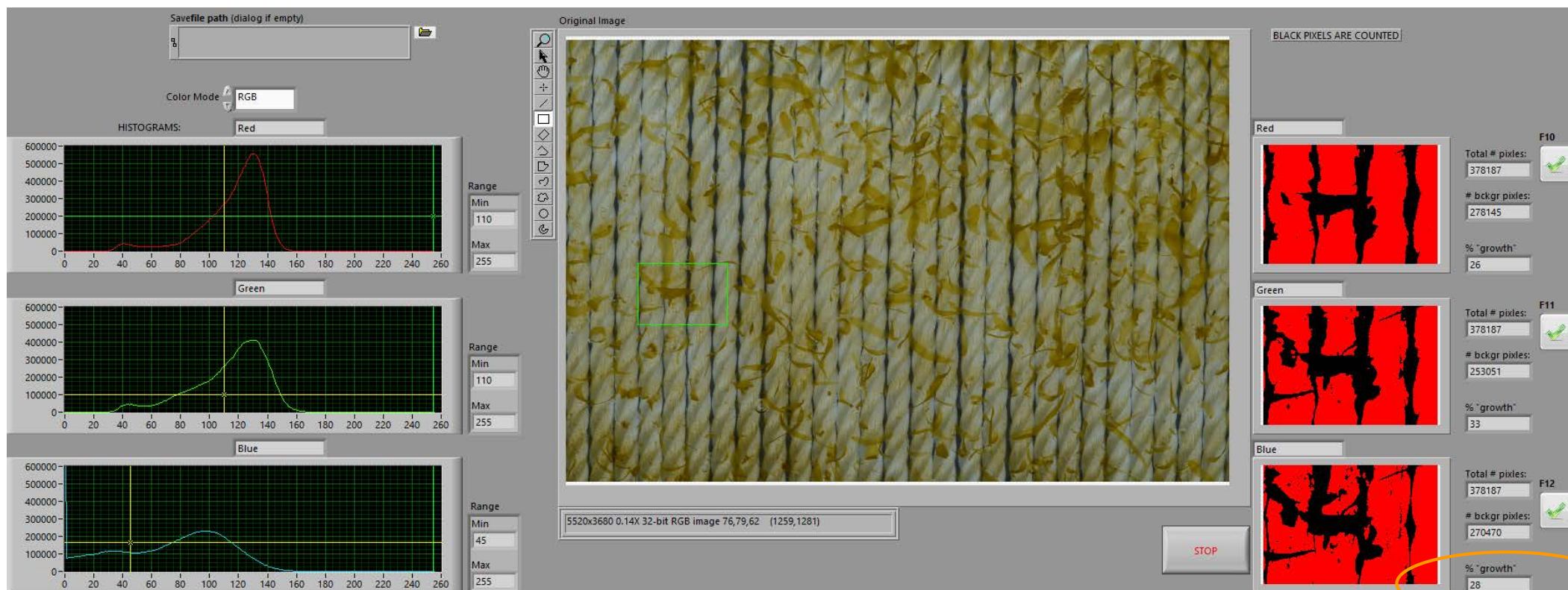
Method
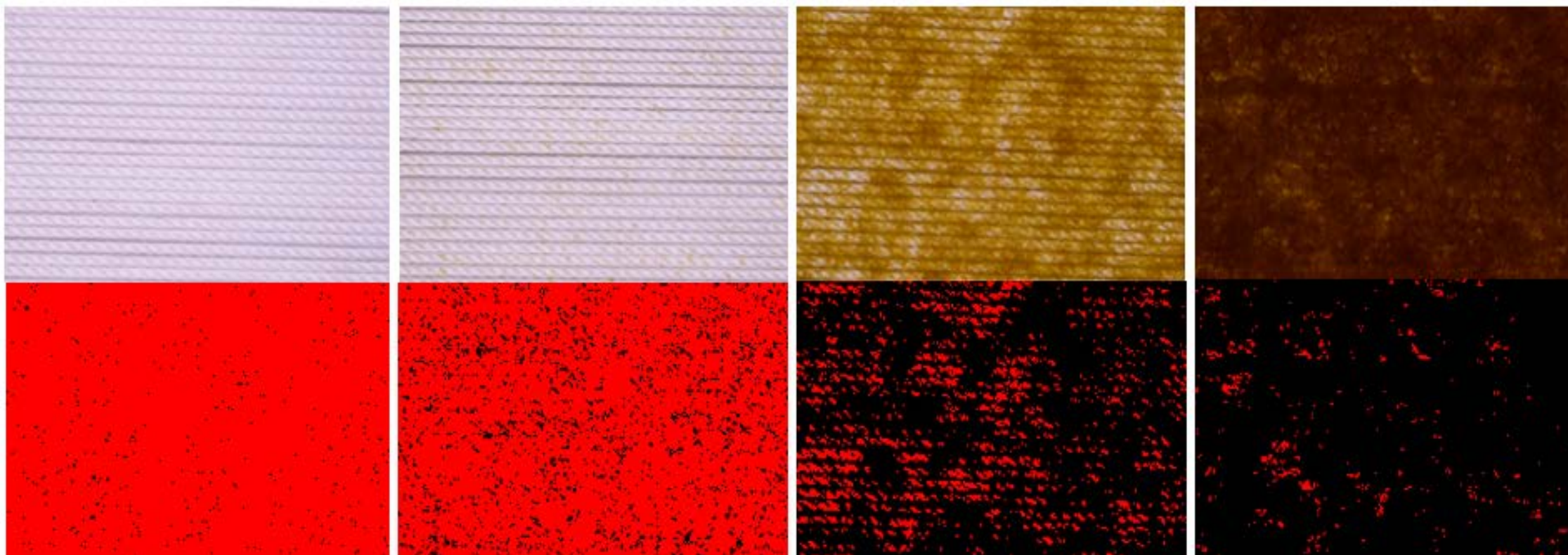
Results, sampling program

Considerations

TECHNICAL

- Will reach saturation when no substrate pixels are visible

- Uses 2D images: Seedlings grow in 3D and may cover substrate pixels slightly (light brown), or heavy (dark brown)

- Solution: For image analysis of larger seedlings, total image brightness might be used

- Combination of >1 channels might be used for better thresholding

PRACTICAL

- May be used as a tool for quality control at large-scale hatcheries

- Variations we observed may have several causes;
  - Genetic diversity
  - Uniformity of lab conditions

- We are redesigning the lab for more uniform conditions

Technology for a better society