Serial Re-Pitching: Two Case Studies

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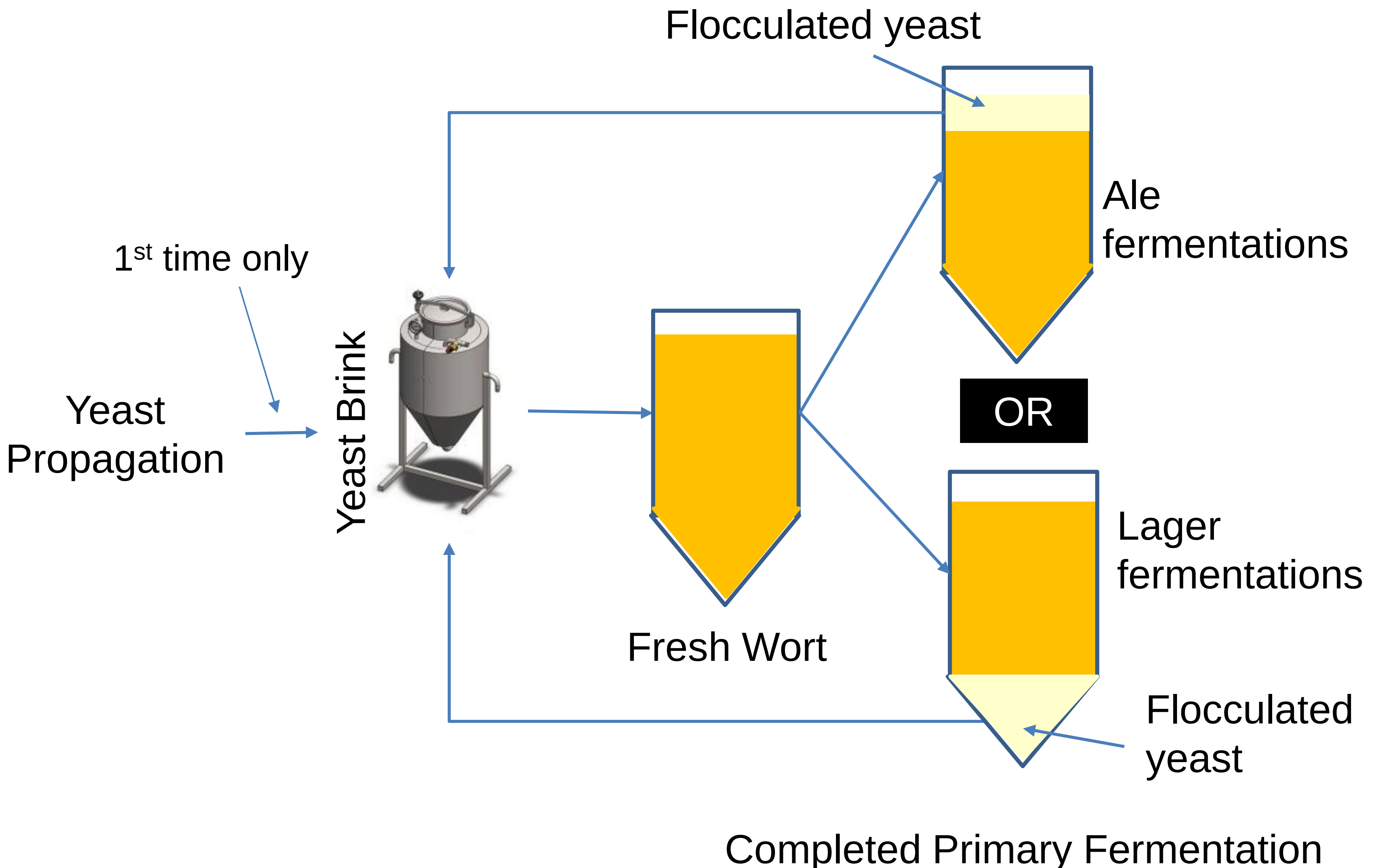
What is serial re-pitching?



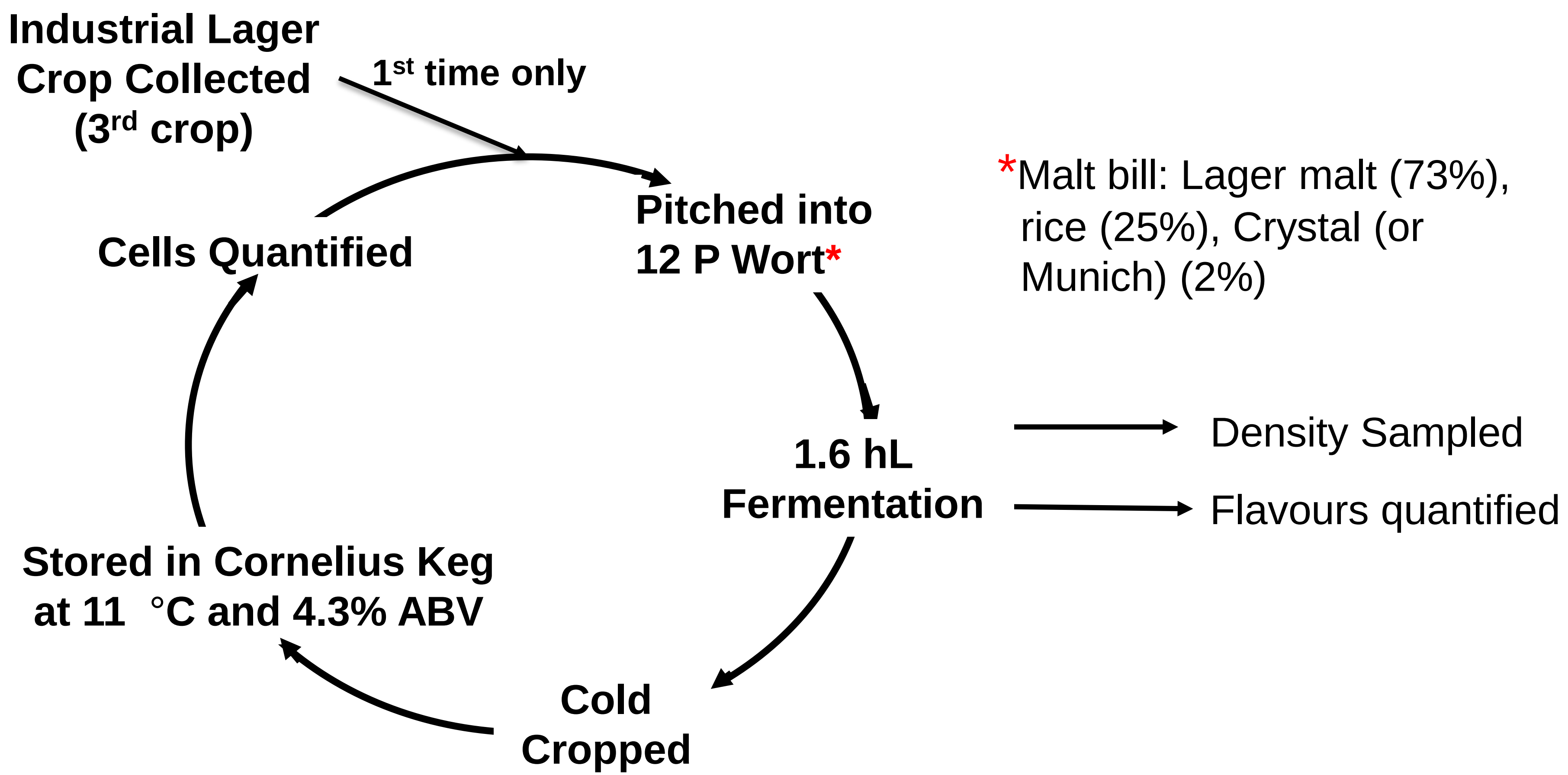
Benefits of serial re-pitching

- Saves time propagating yeast
  - Takes multiple days
- Cost saving
- Reduces first crop yeast use
  - New yeast crops exhibit abnormal fermentation profiles

- **Are breweries maximizing their crop number?**

CASE STUDY:
RE-PITCHED LAGER FERMENTATIONS

Lager Case Study: Experimental Design



Nonlinear Regression Analysis

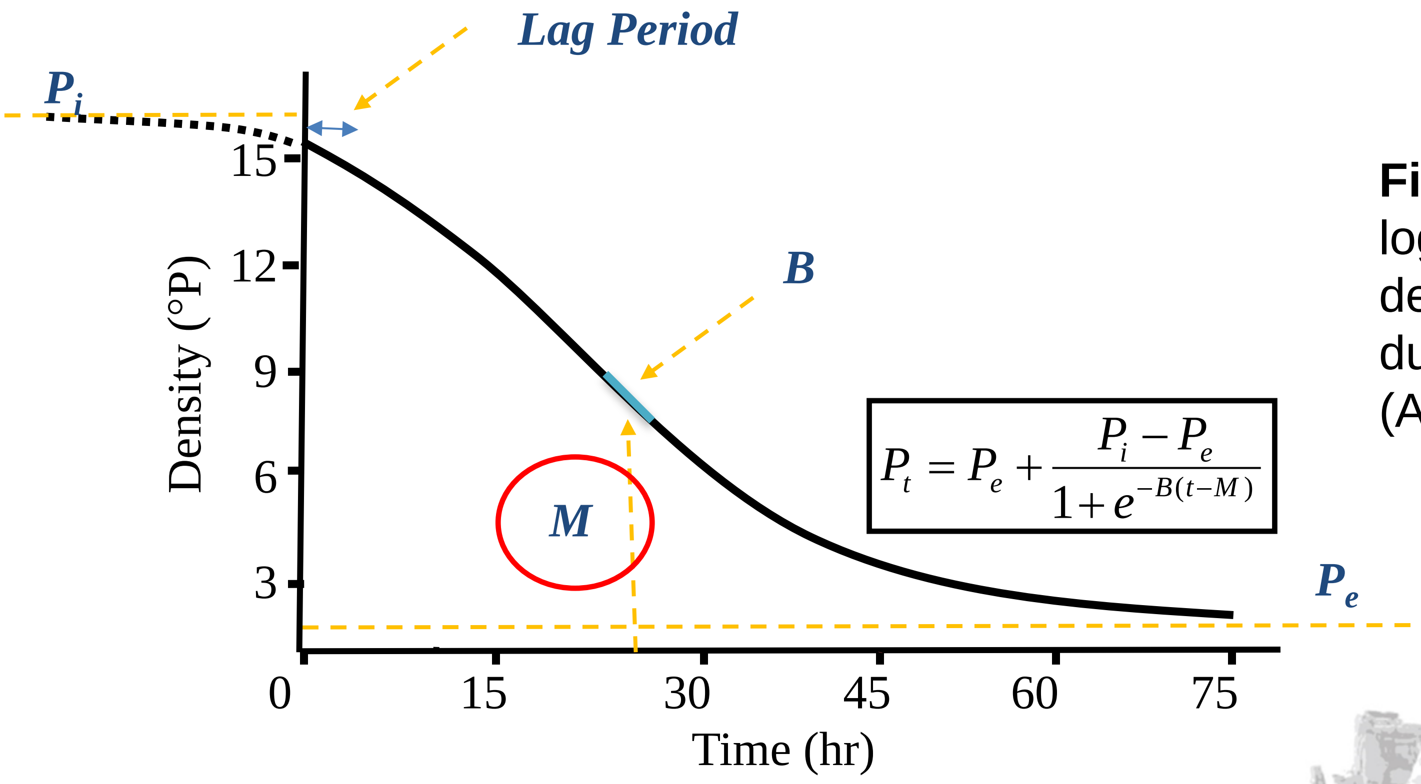


Figure 1. Nonlinear logistic describing density attenuation during fermentation (ASBC Yeast-14)

Significance of density attenuation curves?

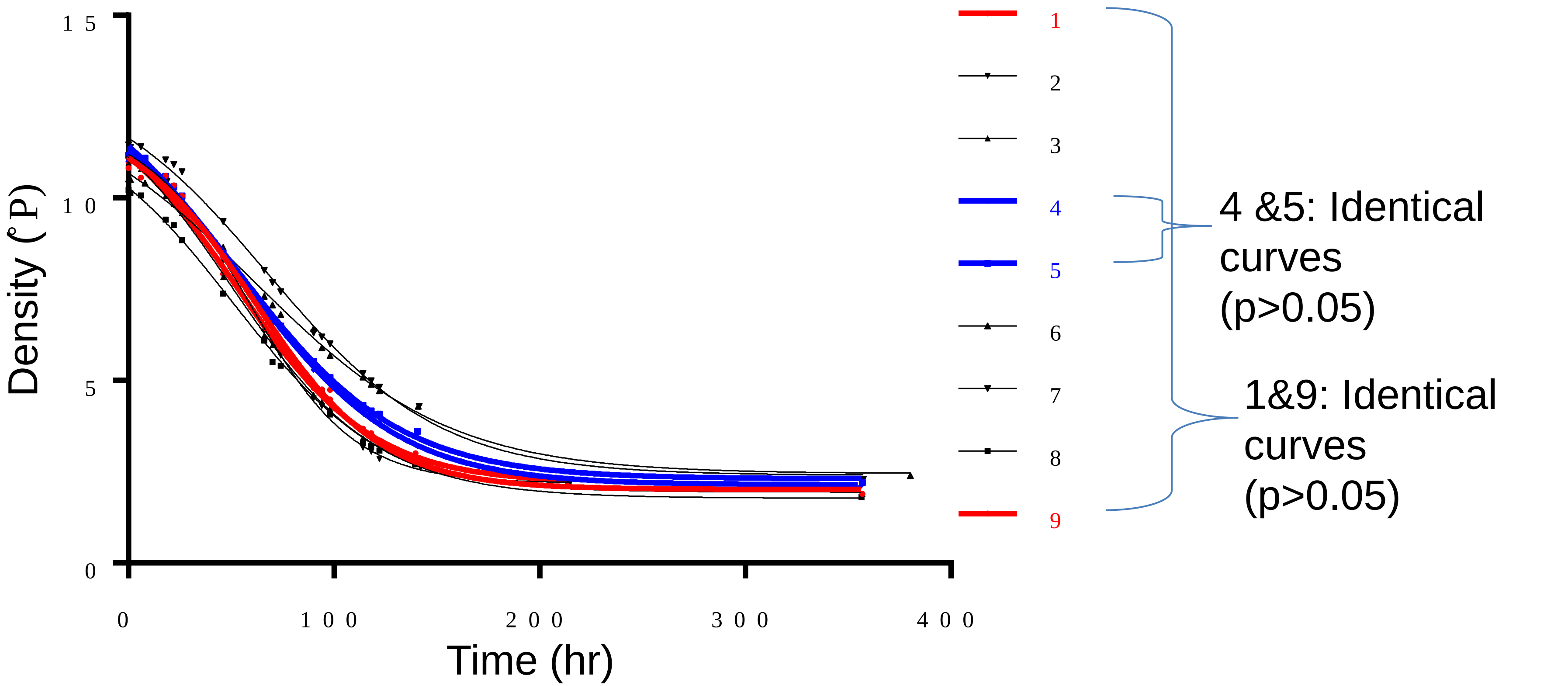
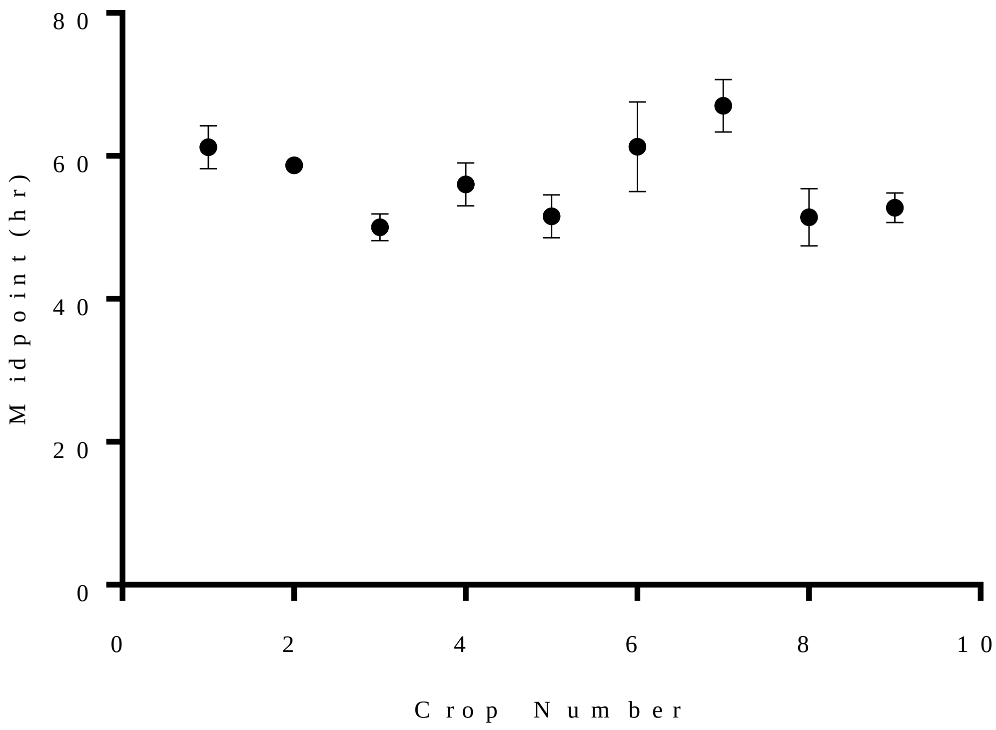


Figure 2. Modelled density attenuation curve for nine re-pitched fermentations, the re-pitched number is noted by individual colours.

Did the length of the fermentation change between crop number?



An F-Test on the slope showed the crop number had no significant ($p>0.05$) correlations to on the midpoint

Figure 3. Midpoint (M) for each serial re-pitched lager fermentation

Ester levels post fermentation with respect to crop number

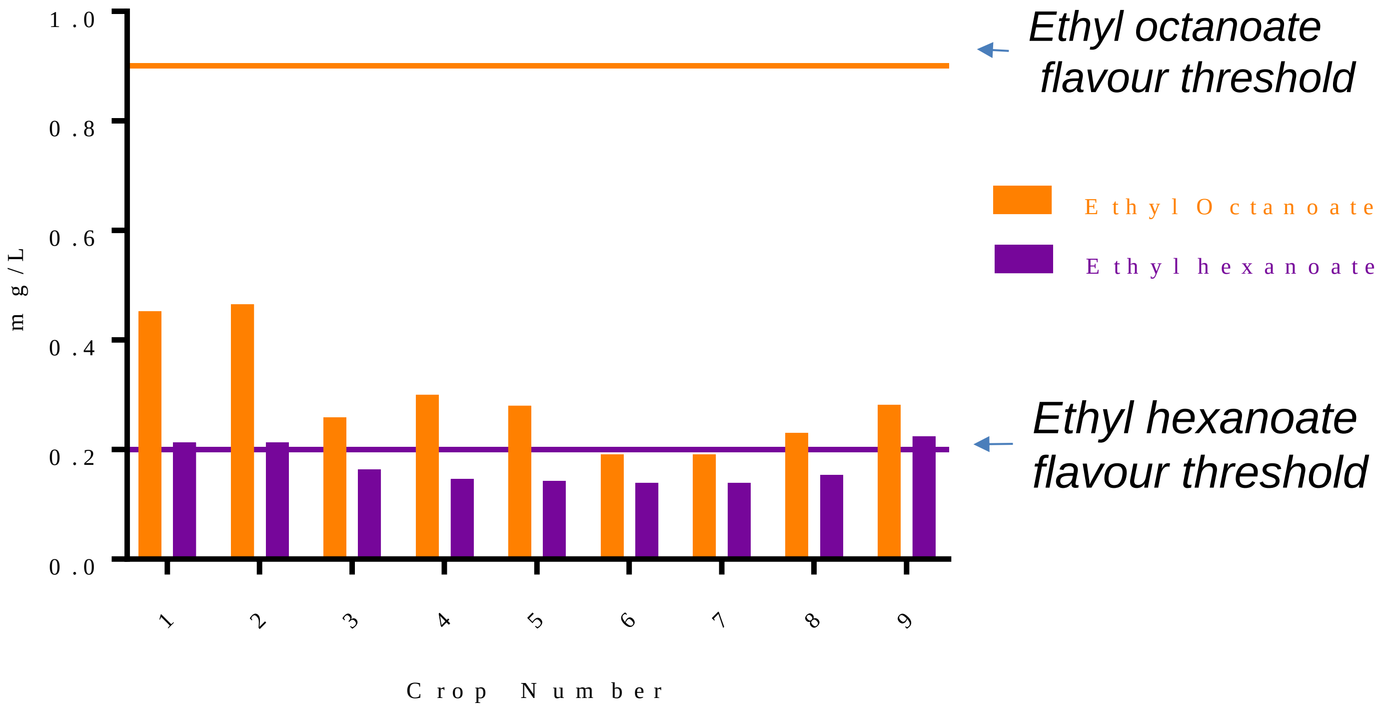


Figure 4. Ethyl ester levels in the beer at hour 122 in fermentation for each fermentation with an increasing crop number

Iso amyl alcohol levels compared to crop number

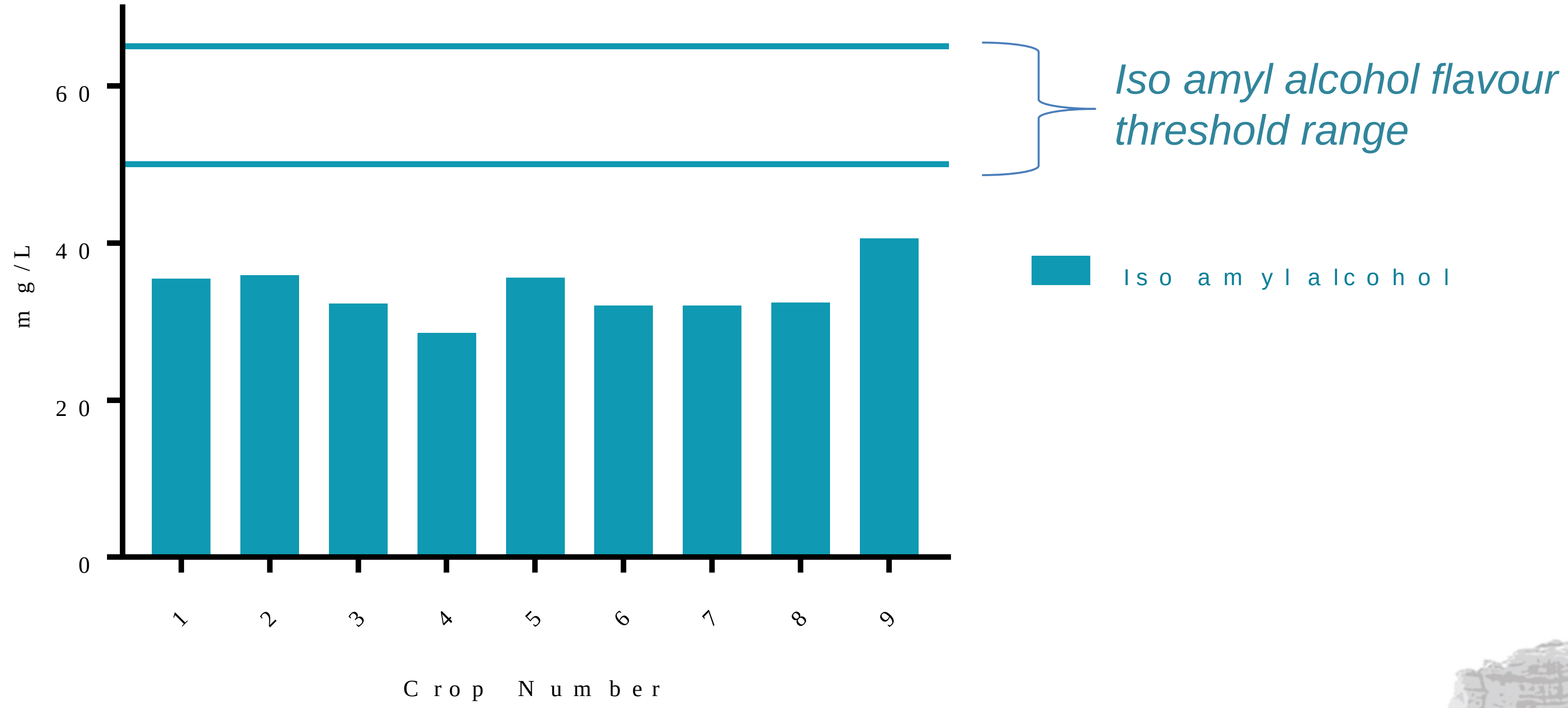


Figure 5. Iso amyl alcohol levels in the beer at hour 122 in fermentation for each fermentation with an increasing crop number

Was the crop number maximized?

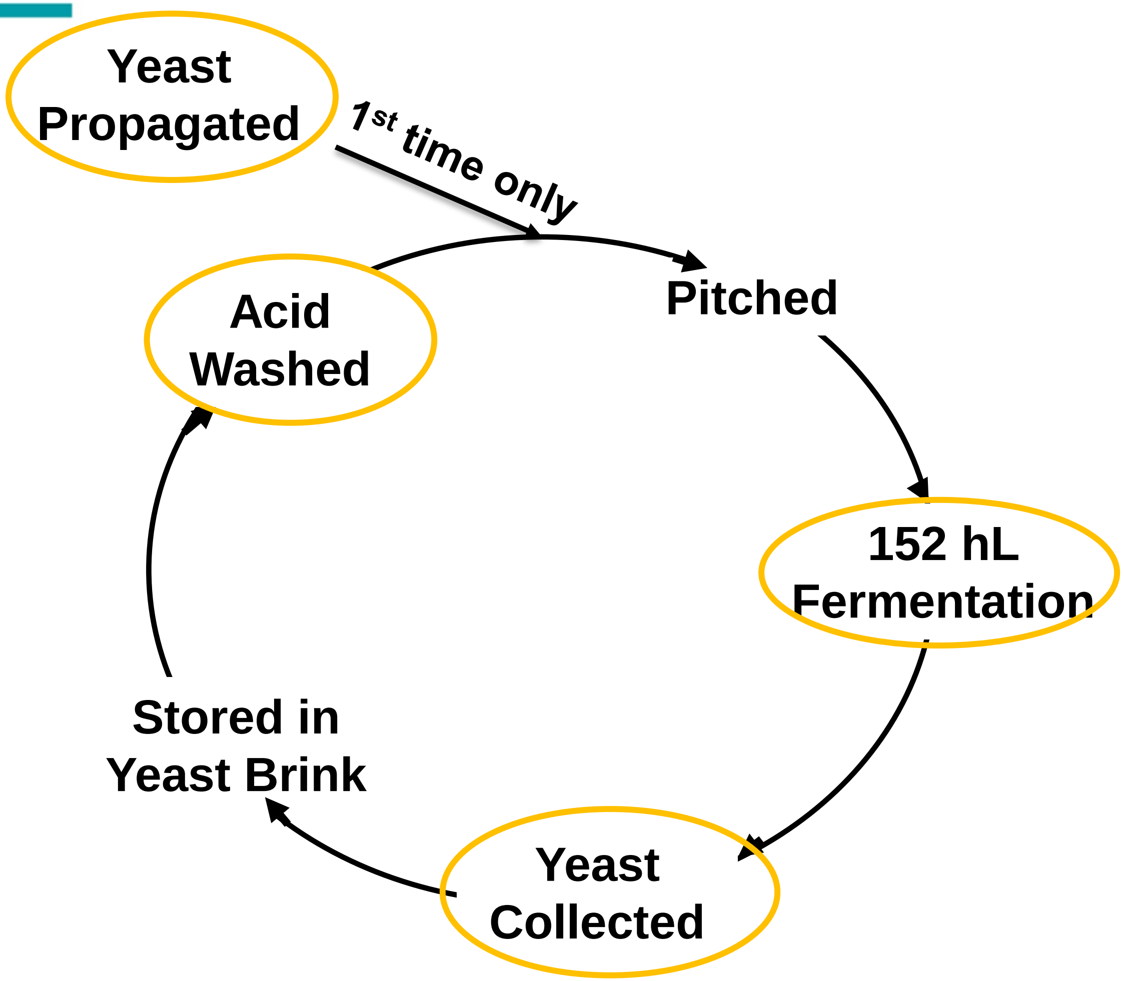
- Density attenuation had no effect on crop number
  - **up to crop number 9**
- Flavour compound levels not correlated to crop number with the exception of ethyl octanoate, which was below flavour threshold

Future work

- Wort analysis along with fermentation monitoring

CASE STUDY:
RE-PITCHED ALE FERMENTATIONS

Ale Case Study: Experimental Design



Fermentation Monitoring

- Density monitored
- Sugar analysis t=0 and 95% complete
- Flavour analysis t=0 and 95% complete
- Initial absorbance (600nm)

Nonlinear Regression Analysis

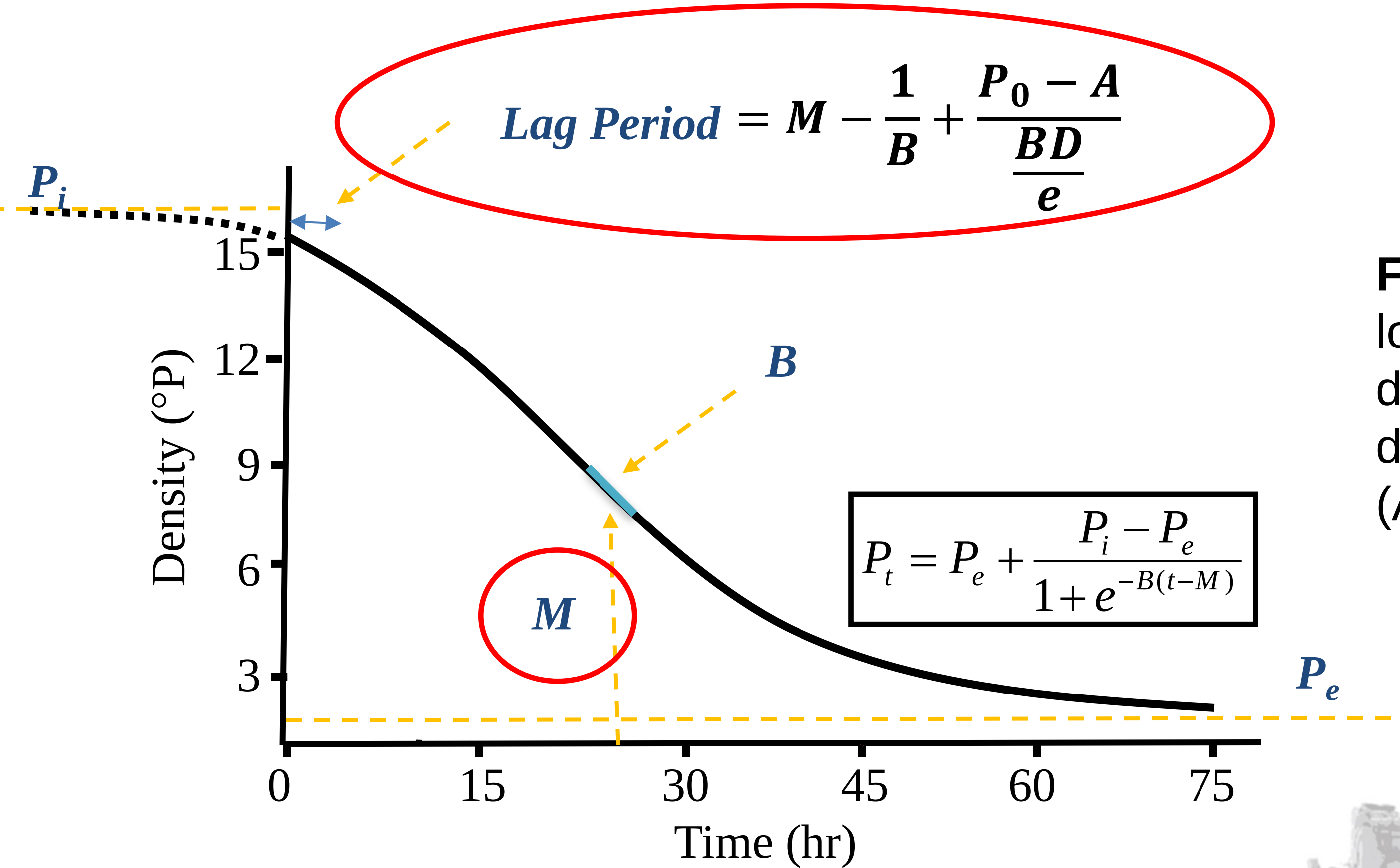


Figure 1. Nonlinear logistic describing density attenuation during fermentation (ASBC Yeast-14)

Significance of density attenuation curves?

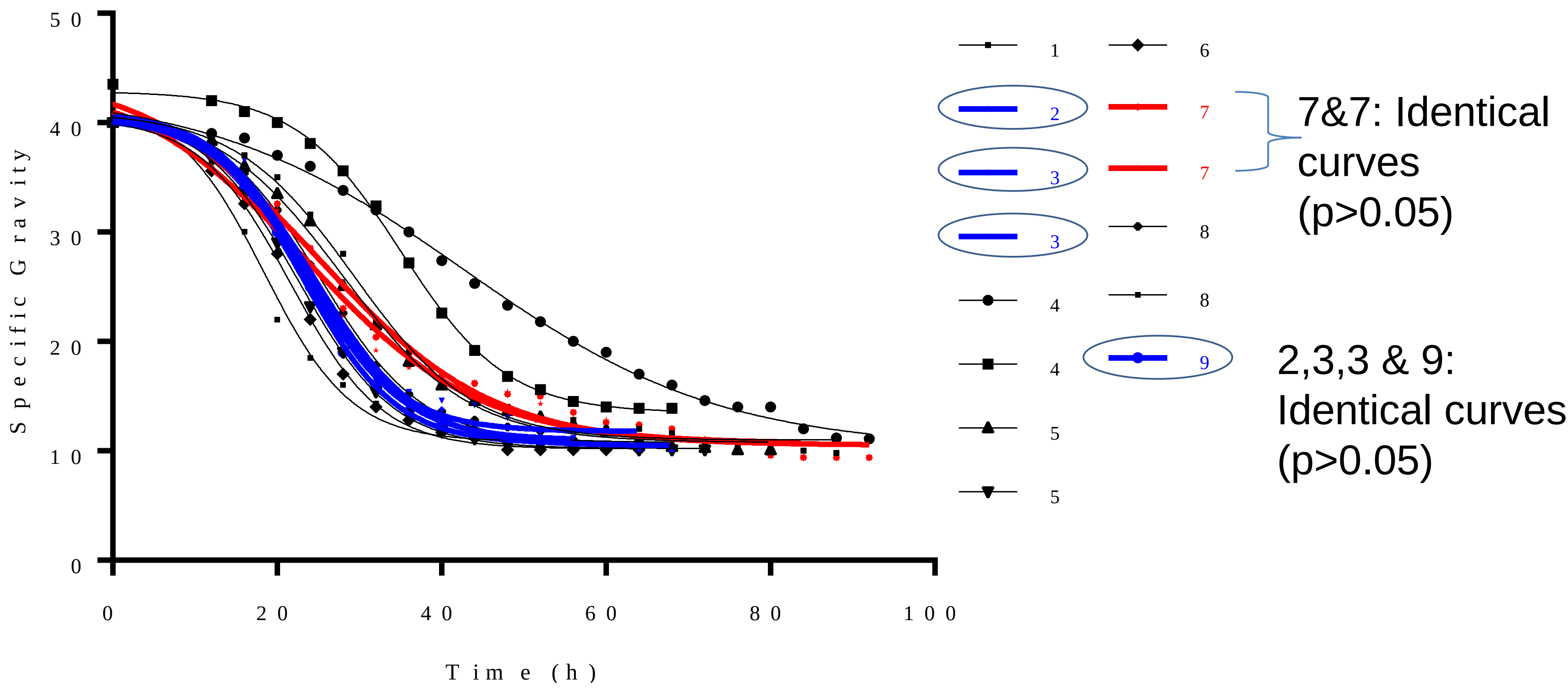


Figure 6. Specific gravity attenuation data with a yeast crop that was re-pitched up to 9 times that was modelled using a four parameter nonlinear regression.

Two abnormal fermentations

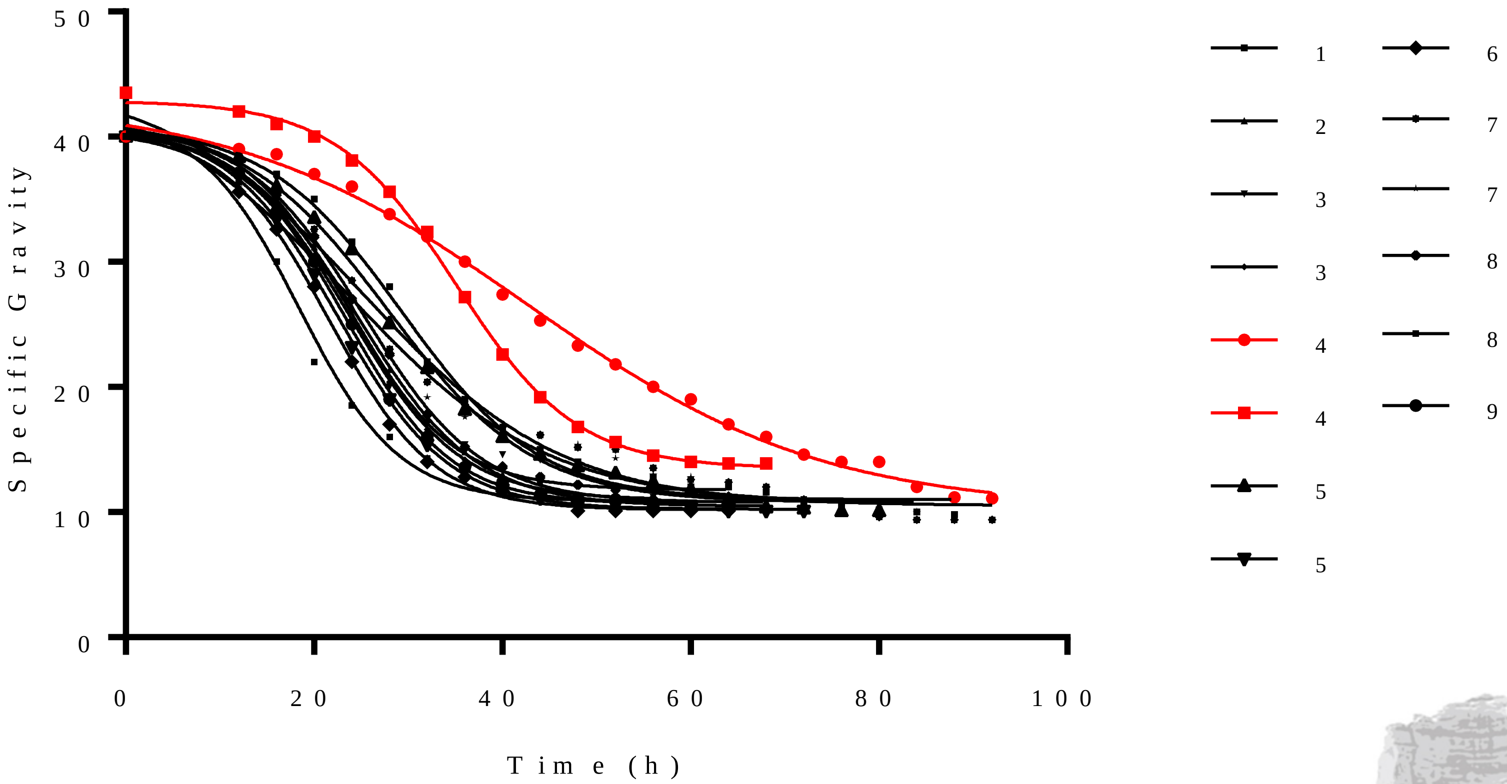


Figure 7. Density attenuation for 9 serial re-pitched ale fermentations highlighting the two abnormal fermentations in red

Abnormal fermentations a result of under pitching

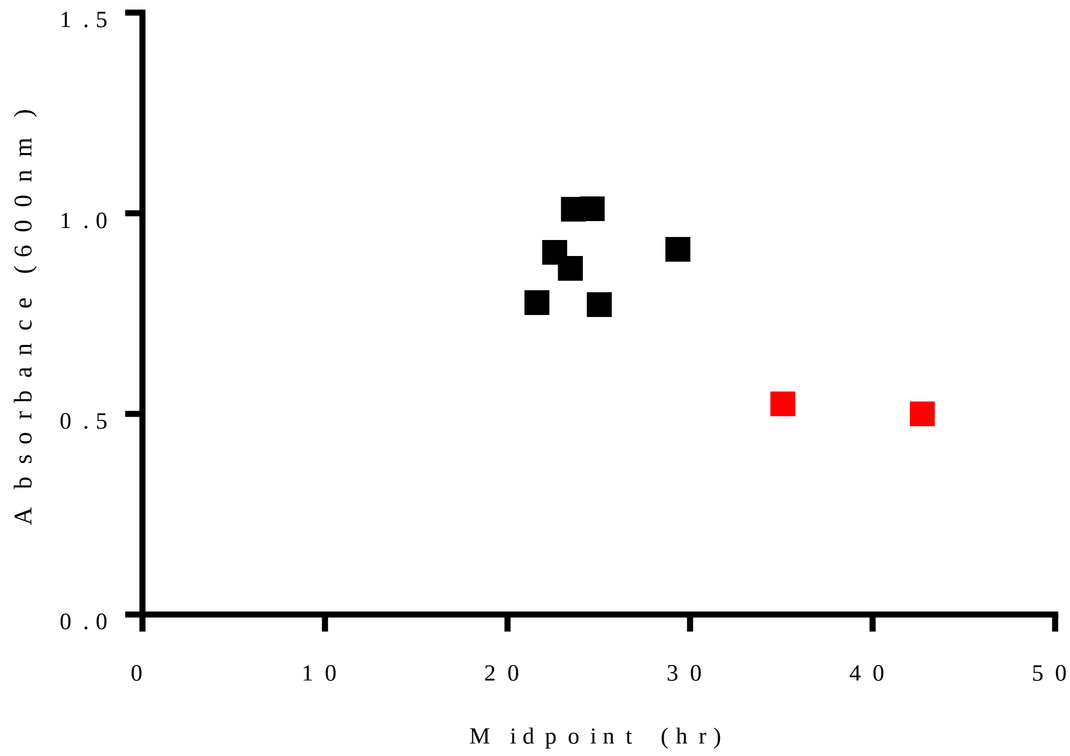
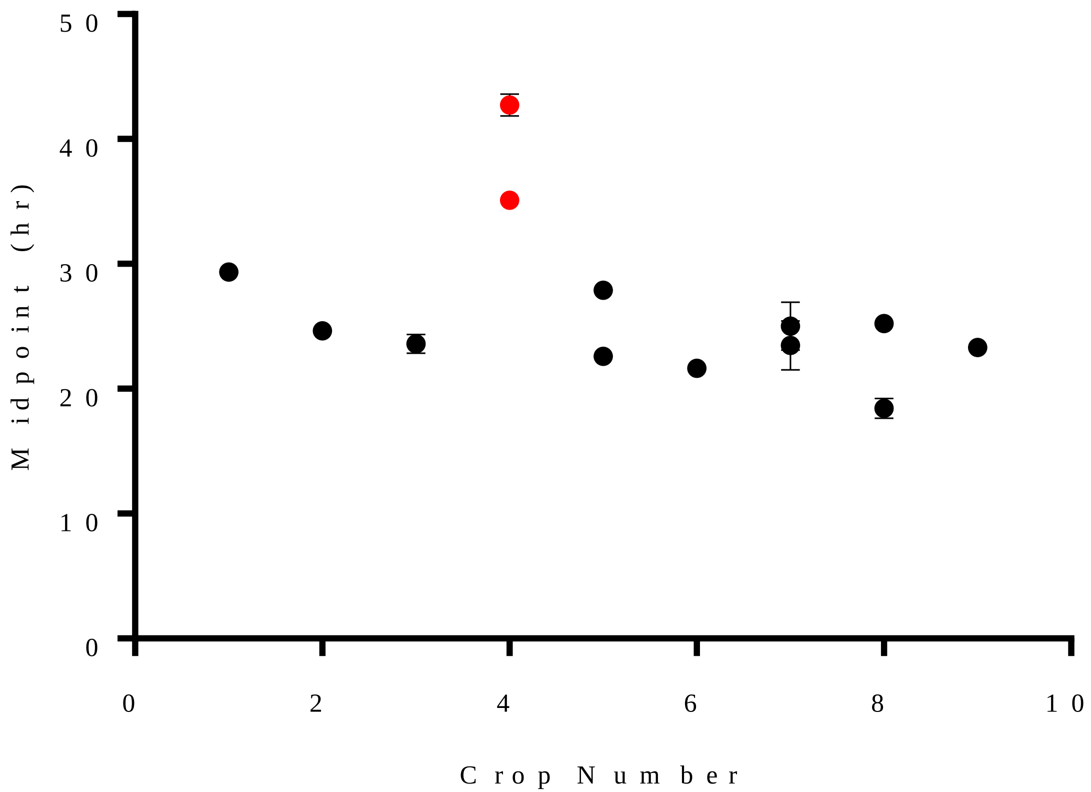


Figure 8. The midpoint of the fermentation compared to the initial absorbance relating to the quantity of yeast at the start of fermentation. The two data points in red are the noted abnormal fermentations

Midpoint (hr) for each serially re-pitched fermentation



An F-Test on the slope showed the crop number had no significant (p>0.05) correlations to on the midpoint

Figure 9. The midpoint for each re-pitched fermentation with the two abnormal fermentations in red.

Ester levels post fermentation with respect to crop number

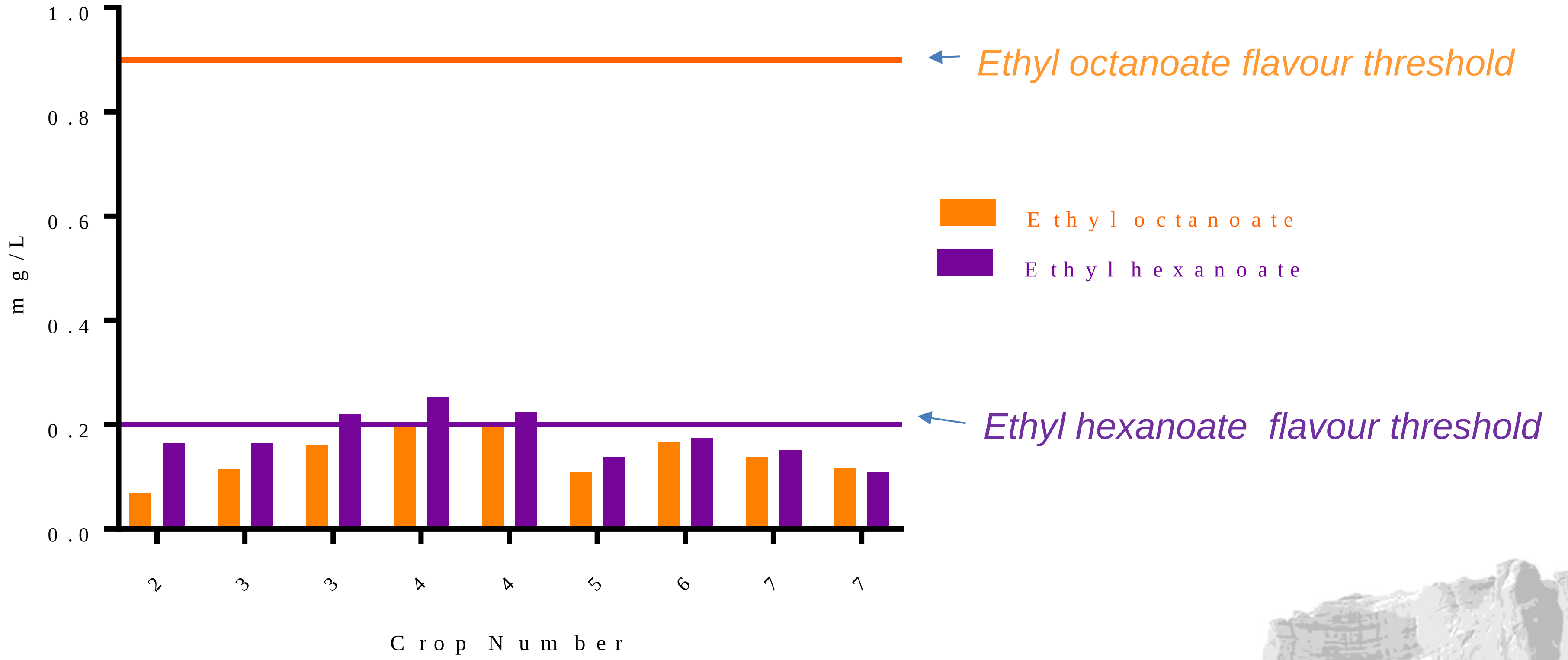


Figure 10. Ethyl ester levels in the beer at 95% complete fermentations as the crop number increased.

Iso amyl alcohol levels with respect to crop number

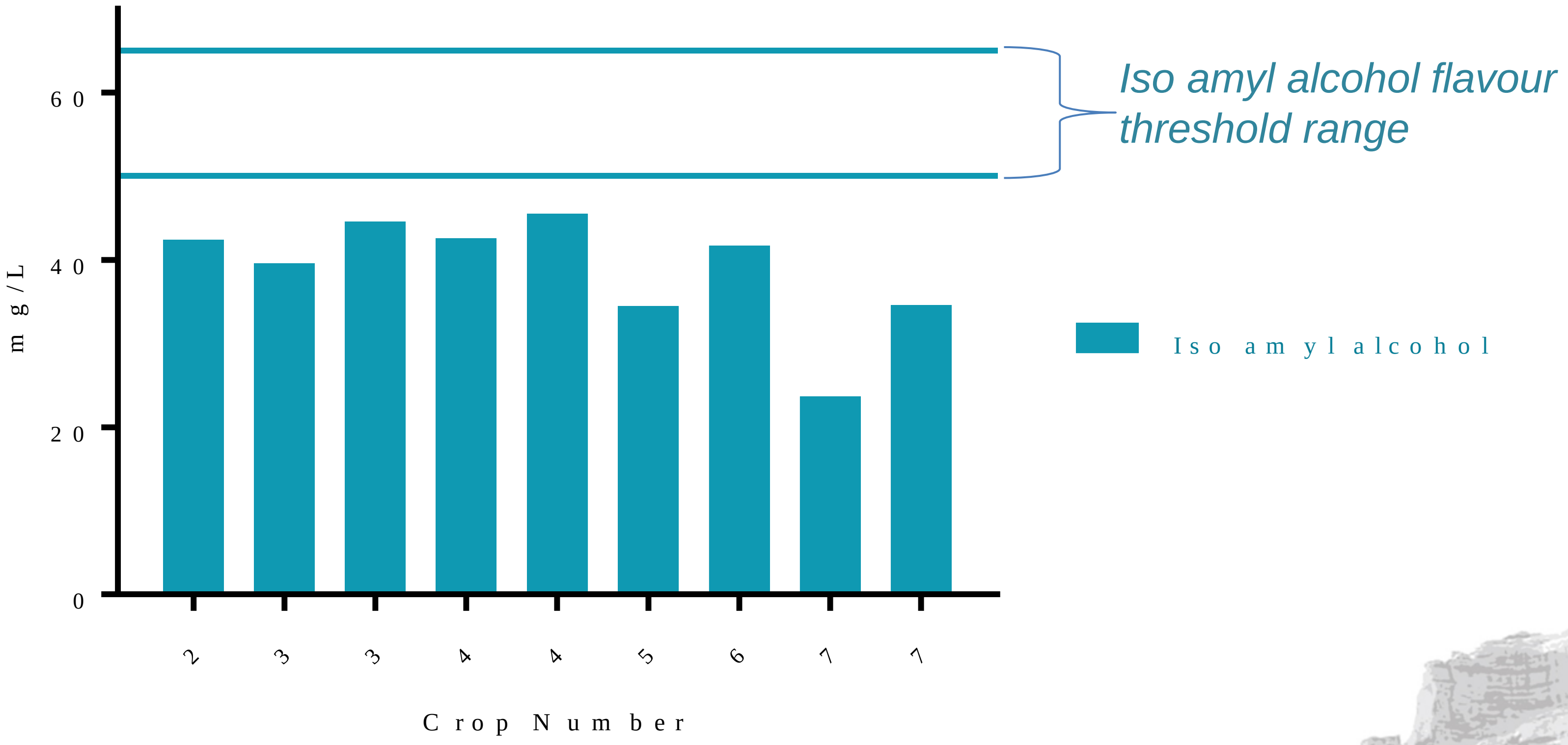
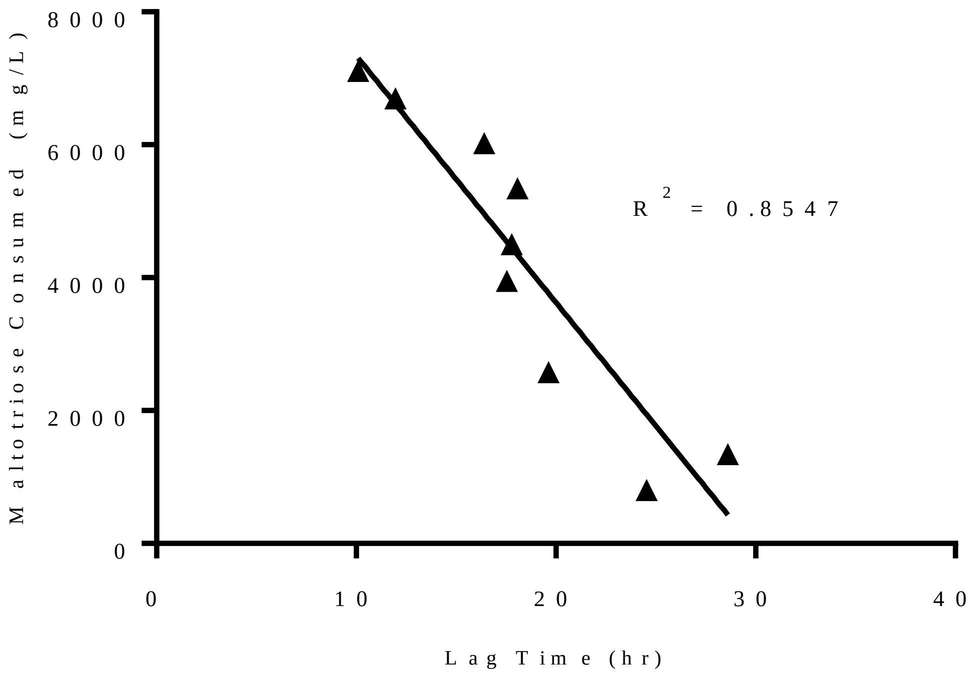


Figure 11. Iso amyl alcohol levels in the beer at 95% complete fermentations as the crop number increased.

Trends in maltotriose consumption with lag period



- As the lag time increased, the maltotriose consumed by 95% complete fermentations decreased

Figure 12. Linear correlations between maltotriose consumed and the lag time of the fermentation

Was the crop number maximized?

- Same as the lager case study, the density attenuation not indicative of drifting in one direction based on crop number **up to crop number 9**

- Flavour compound levels were not correlated to the crop number

Future work

- Maltotriose deserves further investigation

Summary

- With both case studies, there was no indicators that the changes in density attenuation or flavour profiles were due to the crop number

- Potential to investigate extending the crop number

Literature

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Thanks and acknowledgments

- International Centre for Brewing and Distilling (ICBD)
  - Alex Speers (ICBD and Dalhousie)
  - Dawn Maskell
  - James Bryce
  - Annie Hill
  - Matthew Pauley
  - Margaux Huismann
- Scottish breweries
  - Production crew and technical staff
- Institute of Brewing and Distilling

Thank you for listening!

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Vicinal diketone levels post fermentation with respect to crop number (Lager Fermentations)

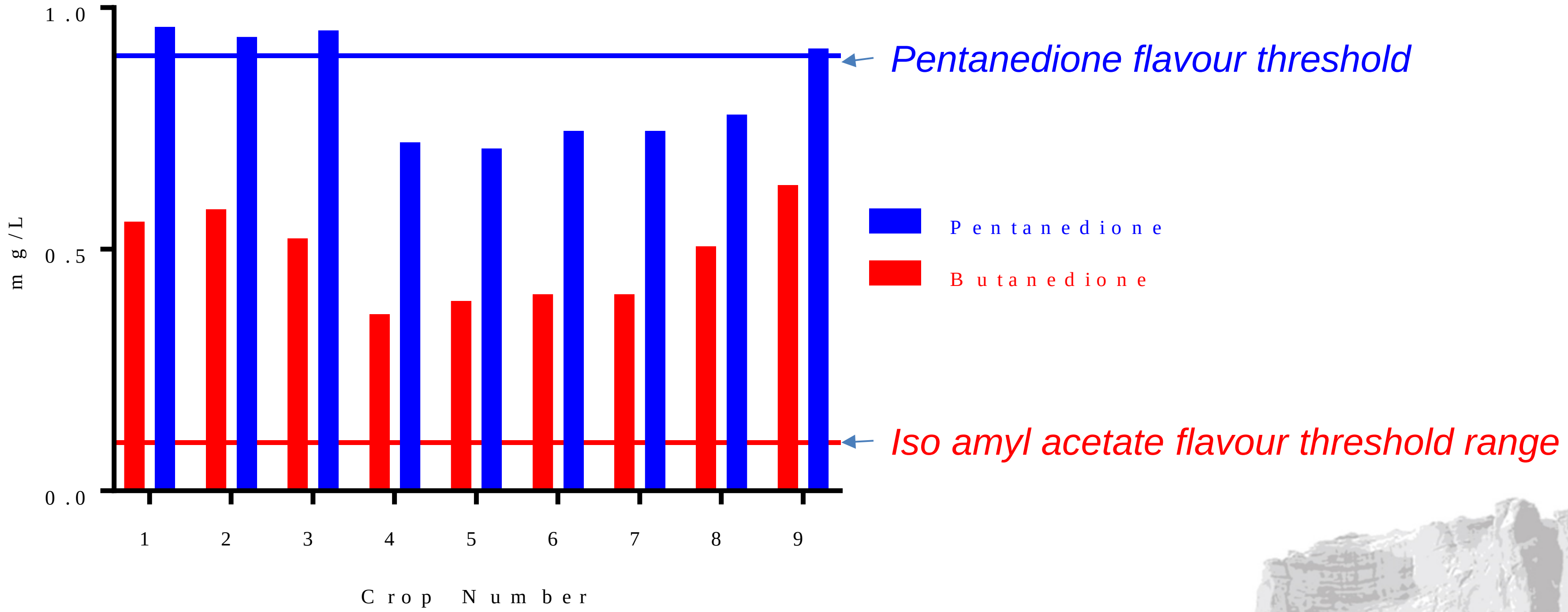

Figure 5. Vicinal diketone levels in the beer at hour 122 in fermentation for each fermentation with an increasing crop number

Vicinal diketones present post fermentation with respect to crop number (Ale Fermentations)

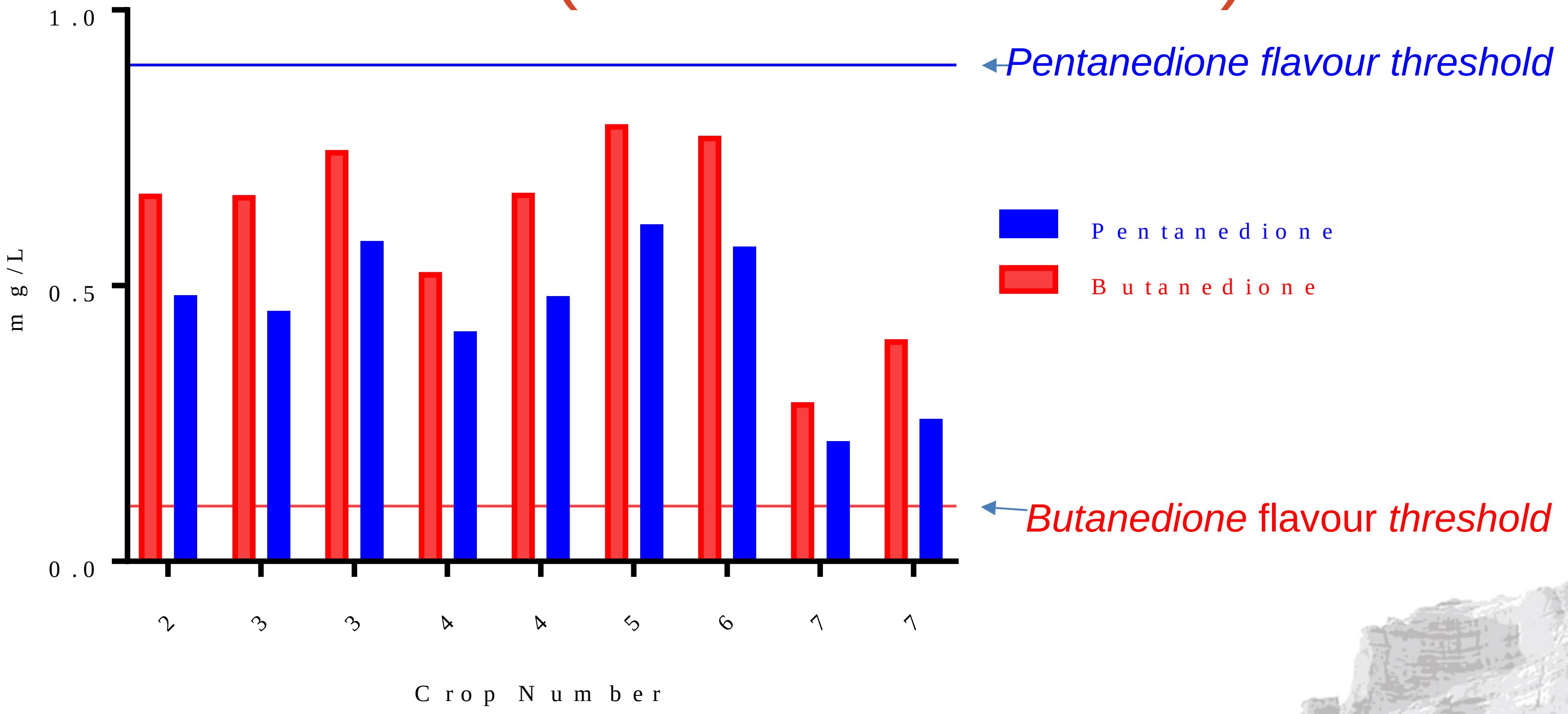

Figure 11. Vicinal diketone levels in the beer at 95% complete fermentations as the crop number increased.

Esters and Higher Alcohols Analysed in the Serial Re-Pitching with Lager Yeast Case Study